

COGNITIVE ADAPTABILITY:
THE ROLE OF METACOGNITION AND FEEDBACK IN ENTREPRENEURIAL
DECISION POLICIES

by

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Decision Policies

Thesis directed by Assistant Professor Dean A. Shepherd

Entrepreneurship scholars suggest that cognition can serve as a process lens through which to “reexamine the people side of entrepreneurship” by investigating the memory, learning, problem identification, and decision-making abilities of entrepreneurs. This dissertation embraces such inquiry through the investigation of how individuals develop “higher-order” cognitive strategies to promote *cognitive adaptability*, which I define as the ability to appropriately evolve individual decision-frameworks in concert with a changing and uncertain environment. I propose that cognitive adaptability underlies an ‘entrepreneurial mindset’ and similar, cognitive conceptualizations of entrepreneurial decision processes (McGrath and MacMillan, 2000; Hitt, Ireland, & Sirmon, 2003).

Cognitive adaptability is enabled through the development of strategies that serve to promote the process of “thinking about thinking,” or more precisely metacognition. Metacognition describes a higher-order cognitive process for organizing what individuals know about themselves, tasks, situations, and their environments in such a way as to facilitate effective and dynamic cognitive functioning.

In this dissertation, I present three complementary studies that investigate the role that metacognition plays in promoting cognitive adaptability in the context of performing an entrepreneurial task – opportunity evaluation. I bring together three streams of literature from psychology – metacognition, situated cognition, and the learning literature focused on cognitive feedback – in a model that attempts to address calls by prominent researchers to bridge cognitive and social psychological approaches in the study of metacognition (Jost, Kruglanski, and Nelson, 1998; Mischel, 1998; Schwarz, 1998b). This research has three goals, specifically to demonstrate that 1) metacognitive awareness promotes ‘cognitive adaptability’ in the context of an entrepreneurial task, 2) that cognitive adaptability, *enabled by*

metacognitive awareness, enhances cognitive functioning in dynamic environments, and that 3) cognitive adaptability, as a function of metacognitive awareness, can be reliably measured.

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CHAPTER ONE

INTRODUCTION AND OVERVIEW

Scholars have suggested that “the successful future strategists will exploit an entrepreneurial mindset...the ability to rapidly sense, act, and mobilize, even under uncertain conditions” (Ireland, Hitt & Sirmon, 2003: 963-989). This conceptualization implies that the ability to sense and adapt in response to uncertainty characterizes a core competence of the successful entrepreneur (McGrath & McMillan, 2000; Ireland, Hitt, & Sirmon, 2003). I propose that the foundation of this competence is, in part, cognitive in its origins. Specifically, from the perspective of cognitive theory, the ‘entrepreneurial mindset’ is analogous to what I describe more generally as *cognitive adaptability*.

Cognitive adaptability represents the ability, if appropriate given the decision context and the goals and motivations of the decision-maker, to overcome – or ‘think outside’ – the bias embedded in existing sense-making mechanisms, such as schema, scripts, and other knowledge structures. It is important to note that I conceptualize cognitive adaptability to include a normative implication, such that adaptable decision-making implies *effective* decisions in the face of a dynamic environment.

In developing the foundations of what Ireland and his colleagues describe as the ‘entrepreneurial mindset,’ the authors’ describe cognitive tasks such as: making sense of opportunities in the context of changing goals, constantly questioning one’s ‘dominant logic’ in the context of a changing environment, and revisiting ‘deceptively simple questions’ about what we think to be true about markets the and firm (Ireland, Hitt, & Sirmon, 2003). Cognitive adaptability is consistent with such a

focus, in that it represents the recognition that decisions and sense-making occur in a complex, dynamic, and social environment.

In the context of cognitive adaptability, it's noteworthy that most everything we know about cognitive science, social psychology, and learning posit that to truly realize an 'adaptable' mindset, the *thinking individual* is fighting an uphill battle. Put simply, the flexibility implied in the 'mindset' that Ireland and his colleagues describe is *dependent* on the individual's ability to cognitively adapt how he/she makes sense of a changing and uncertain environment, and to subsequently evolve decision-making frameworks in concert with that environment. This ability implies the necessity to overcome the bias embedded in learned sense-making mechanisms, such as schema, scripts, and other knowledge structures. Research has demonstrated that such adaptability is exceedingly difficult (Rozin, 1976). It is the purpose of this dissertation to investigate the cognitive processes associated with promoting cognitive adaptability in the face of the dynamism and uncertainty that characterize the entrepreneurial environment. I suggest that cognitive adaptability is the antecedent to realizing an entrepreneurial mindset (and other, similar conceptualizations of entrepreneurial thinking), and that cognitive adaptability is enhanced as a function of metacognitive awareness.

Given that cognitive adaptability is necessitated by the unique characteristics of the entrepreneurial context, I will begin this chapter with a discussion of the entrepreneurial environment in the context of cognitive theory. I will then discuss - generally - the relationship between cognitive processing, metacognition, and characteristics of the entrepreneurial environment which may serve to inhibit

cognitive adaptability. This chapter will conclude with an overview of the central research questions investigated by this dissertation, the conceptual models developed and tested, and an overview of the methods employed in hypotheses testing.

The Entrepreneurial Environment

Entrepreneurship research describes the entrepreneurial task (and the environment surrounding that task) as inherently dynamic, risky, and uncertain (Knight, 1921; McGrath, 1999; Zahra, Neubaum & El-Hagrassey, 2002). Cognition has been studied as a mechanism that partially explains the entrepreneur's role in making sense of that uncertain, dynamic environment (Krueger, 2000; Mitchell, Smith, Seawright & Morse, 2000). Research suggests that the influence of the characteristics of the environment (uncertainty, task novelty, dynamism, etc) on cognition is not static and objective, but dynamic and perceptual (Hilton, 1995; Neuberg, 1989; Schwarz, 1996; Tetlock, 1992). These findings imply that not only are the characteristics of the environment (as perceived) idiosyncratic to the individual actor, but also that as the environment evolves and unfolds, effective decision-making is dependent on the ability of the entrepreneur to evolve his/her sense-making mechanisms in concert with the environment.

Scholars of both strategy and entrepreneurship seem to universally agree that the environment plays a significant role in influencing both individual and organizational decisions. While disparate theoretical approaches, frameworks, and constructs compete for journal space, central to them all (either implicitly or explicitly) is the premise that the environment matters. As an example, consider one

of the dominant research paradigms applied in strategy research today – the Resource-Based View.

The Resource-Based View (RBV) confers competitive advantage based on the firm's ability to acquire and leverage rare, valuable, and inimitable resources. It has been suggested that decisions as to *how* to leverage these resources (i.e. in what markets, in what combinations) is a function of the decision-maker's expectations as to the utility of the resource (Makadok, 2003). Therefore one could argue that to truly understand the origins of competitive advantage in the context of Resource-Based View, it is necessary to understand how characteristics of the environment influence the mechanisms through which decision-makers 'make sense' of that environment. Alvarez and Busenitz suggested a similar argument, when they proposed to extend the boundaries of the Resource-Based View to include the individual cognitions of the entrepreneur (2001).

Employing logic similar to what was developed above suggests that researchers focus on the role of the environment on decision-making across the range of research topics popular with strategy and entrepreneurship scholars: top-management teams, high-technology, diversification, organizational structure, organizational knowledge and learning, strategic alliances, strategic groups. However while entrepreneurship and strategy scholars generally agree that characteristics of the environment are important inputs to the decision-making process, the question, as of yet not satisfactorily addressed, is *how* the environment matters in terms of the extent to which entrepreneurs and managers incorporate changing inputs from the environment into iterative, decision processes.

That said, cognition as a theoretical framework applied to strategy and entrepreneurship research poses significant challenges when it comes to understanding the relationship between the characteristics of the environment, and how those characteristics moderate individual and organizational decision-making.

Returning to the Resource-Based View again as an example suppose that I, as a researcher, am interested in the relationship between the environment and the *value* of a given resource. It is possible, and in fact highly likely that I – as an outside observer - could arrive at some measure of the value of the resource and empirically link that value to some set of environmental attributes.

The role of the environment under RBV – for the researcher imposing some arbitrary measure post hoc - is measurable. However I would argue that my assessment of the value of that resource does little to help me understand the assessment that may matter most in the context of understanding strategic decision-making – the assessment of the entrepreneur or manager who ultimately decides the utility of the resource and how that resource is employed in generating economic rents returned to the firm.

The role of the environment in influencing individual and organizational decisions, in the context of cognitive theory, is not objective and readily ‘measurable’ because – I’d suggest - that researchers have yet to find a reliable way to un-package the cognitive ‘black box’ responsible for sense-making and decision policies. The environment serves as an input to the ‘black box,’ and its influences on cognitive processing and sense-making are understudied in both the strategy and entrepreneurship literatures. That said, in the context of a construct like the

entrepreneurial mindset, the challenge becomes not only to understand how the dynamic, uncertain environment influences sense-making and decision policy, but to also investigate mechanisms to foster an individual's ability to adapt decision policies in the face of the changing environment. While a challenging research proposition, I suggest that such a framework serves to highlight the 'other side of the cognitive coin' by asserting that there is a need for research investigating how the entrepreneur can think beyond existing heuristics and remain cognitively adaptable in an inherently uncertain and dynamic environment. While entrepreneurship research on cognition continues to proliferate, it has focused primarily on the cognitive processes and mechanisms that *inhibit* adaptability. Research on counterfactual thinking (Baron, 2000), biases in scripts and schema (Mitchell, Smith, Seawright, & Morse, 2000), extensive use of heuristics (Alveraz & Busenitz, 2001), an overconfidence bias (Busenitz and Barney, 1997; Keh, Foo, & Lim, 2002) focus on cognitive rigidity in entrepreneurs, instead of exploring cognitive processes that promote adaptability and facilitate effective decision-making in dynamic environments.

Entrepreneurship researchers have attempted to articulate, and in some cases empirically test, the 'dimensions' of the entrepreneurial environment. It has been suggested that these dimensions offer a basis for understanding the underlying relationship between the entrepreneurial environment, and how the entrepreneur makes sense of that environment. An abbreviated summary of the dimensions which define the entrepreneurial environment (as proposed by entrepreneurship scholars) is presented at Table 1.1:

Table 1.1. Dimensions of Uncertainty

Gnyawaii & Fogel (1994)	government policies and procedures socioeconomic conditions individual level skills financial support non-financial support
Weaver et al (2002)	general uncertainty/environmental change technological volatility actions of competitors/customers international markets/expansion
Baum et al (2001)	environmental predictability/dynamism availability of outside resources/munificence many/few competitors/complexity

While in the aggregate this is a disparate set of criteria, I would argue that the ideas of *uncertainty* and *dynamism* unify the dimensions identified above, and therefore serves as a useful construct for the purposes of this dissertation to explore the idea of how entrepreneurs cognitively adapt to an ever evolving and unfolding environment.

The three most commonly cited definitions of “environmental uncertainty” imply a perceptual phenomenon, and therefore it would be difficult to dismiss the idea that how individuals make sense of a given environment is moderated by the uncertain nature of that environment. Those definitions are as follows:

- “*An inability to assign probabilities as to the likelihood of future events*” (Duncan, 1972; Pennings, 1981; Pfeffer & Salancik, 1978)
- “*A lack of information about cause-effect relationships*” (Duncan, 1972; Lawrence & Lorsch, 1967)
- “*An inability to predict accurately what the outcomes of a decision might be*” (Downey, Hellriegel & Slocum, 1975; Duncan, 1972; Schmidt & Cummings, 1976)

The idea of uncertainty is fundamental to entrepreneurship (Knight, 1921).

Most of the literature positioned to describe the entrepreneurial environment defines its characteristics based on 'applied' dimensions of uncertainty (technological change, government regulation). Focusing a cognitive lens of the relationship between cognitive processing and the environment, the question then becomes: given an uncertain environment, how does the uncertainty dimension influence cognitive functioning as the entrepreneur pursues the development of new products, entry into new markets, and the growth of new ventures?

Like uncertainty, dynamism is a construct often applied to characterize the business environment (Dess & Beard, 1984; Shimizu & Hitt, 2004; Hough & White, 2003). The influence of dynamic, environmental contexts on the decision-making process has been the focus of considerable interest, speculation, and research. For example, Eisenhardt has examined the effectiveness of decisions executed in dynamic environments (1989); Priem and his co-authors considered the 'rationality' of strategic decision processes given both stable and dynamic environments (Priem, Rasheed, & Kotulic, 1995); and Fredrickson related inferior economic performance to decision-making in unstable, dynamic environments (Fredrickson, 1984; Fredrickson & Mitchell, 1984). Each of these authors suggested that the influences of dynamism on strategic decision-making should continue to be the subject of robust, thoughtful research. The most cited definition of dynamism employed in management literature defines a dynamic environment as one characterized by unpredictability, and a high rate of change absent a particular pattern (Dess & Beard, 1984). I believe this conceptualization serves to unify dynamism (high rate of change) and uncertainty

(change absent a predictable pattern). Thus, from this point forward I will relate dynamism to cognitive adaptability, and the reader should assume my use of the construct implies both dynamism (high rate of change) *and* uncertainty (change absent a predictable pattern).

As a first step in opening the black box to explore the relationship between cognition and context, I propose that people may differ in terms how dynamism influences cognitive processing. From a practical, research perspective, however answering that question becomes a challenge because despite its theoretical significance, the construct as conceptualized here has generally: 1) yielded inconsistent/difficult to interpret results due to poor reliability and validity of measurement instruments, and 2) suggested no clear evidence of a relationship between objective characteristics of the environment and perceptions of uncertainty (Milliken, 1987; Priem, Rasheed, & Kotulic, 1995; Duncan, 1972; Downey et al., 1975).

However I suggest that investigating the relationships described above, from the perspective of cognitive adaptability, may serve to overcome many of the theoretical and empirical challenges encountered by researcher to date. This is *because* the focus shifts from how dynamism influences decision policies, toward how the influences of dynamism can be mitigated by promoting a state of cognitive adaptability where individuals are able to effectively and appropriately evolve decision policies (i.e. to learn) given feedback and inputs from the environment.

Cognitive Adaptability and the Entrepreneurial Environment

Entrepreneurship scholars engaged in cognitive research generally investigate how individuals identify entrepreneurial opportunities and subsequently act upon them. Many suggest that cognition can serve as a process lens through which to “reexamine the people side of entrepreneurship” (Mitchell et al., 2002: 93) by delving into the memory, learning, problem identification, and decision-making of entrepreneurs (e.g. Baron, 1998; Busenitz & Barney, 1997). I embrace the perspective that cognition - as a theoretical lens applied to entrepreneurial problems - has the potential to offer insights into the dynamic interplay between the entrepreneurial context, individual thought, and human motivations. However as I noted previously, while entrepreneurship research on cognition proliferates, its focus has primarily been on the cognitive processes and mechanisms that *inhibit* adaptability (Baron, 2000; Mitchell, Smith, Seawright, & Morse, 2000; Alvarez & Busenitz, 2001; Busenitz and Barney, 1997; Keh, Foo, & Lim, 2002), rather than exploring those cognitive processes that may *promote* adaptability and thus facilitate effective decision-making in the context of a dynamic environment.

This is not a criticism of the extant entrepreneurship research. On the contrary I believe that the work cited above is important and represents the core of what we currently understand about the relationship between individual, cognitive processes and entrepreneurial outcomes. My purpose here is to highlight that there is also a place for research focused on cognition as a dynamic process, investigating the mechanisms through which the entrepreneur can think ‘beyond’ existing, biased heuristics thus remaining cognitively adaptable in an environment that is inherently dynamic.

Entrepreneurs such as John Chambers of Cisco Corporation, Charles Schwab, Richard Branson of Virgin-Atlantic, and Paul Orfalea of Kinko's describe cognitive strategies such as thinking in pictures, employing analogies, and synthesizing information relative to some goal as critical 'thinking' techniques they developed to overcome the complexity of the business environment. Each entrepreneur credits these techniques for helping him identify opportunities, consider alternatives, and overcome dynamism in a way fundamentally different from their contemporaries (Fortune, 2002). In the context of cognitive science, these techniques describe textbook examples of learned strategies that promote the process of "thinking about thinking," or more precisely *metacognition*.

Schraw and Dennison define metacognition as "the ability to reflect upon, understand, and control one's learning" (1994). Metacognition describes a higher-order cognitive process that serves to organize what individuals know and recognize about themselves, tasks, situations, and their environments in order to promote effective and *adaptable* cognitive functioning in the face of feedback from complex and dynamic environments. Given the inherent complexity and dynamism that characterize entrepreneurial environments, the ability to engage metacognitive processes is related to the entrepreneur's ability to cognitively adapt, and therefore perform effectively given an evolving and often novel context.

For example, consider an experienced entrepreneur faced with the challenge of deciding the most appropriate avenue through which to secure funding for her venture. The entrepreneur has knowledge, accessible at a metacognitive level, of various strategies for securing such funding (angels, friends & family, venture capital,

etc), as well as past experiences funding similar ventures. The entrepreneur also has intuitions as to the most appropriate funding source given the nature of the particular venture. This knowledge is enacted through the development of a metacognitive strategy – a strategy for ‘thinking about thinking’ given the task at hand – focused on the most appropriate cognitive response so as to realize the goal of funding the venture. Put more simply, consider a set of available cognitive responses to the funding task as analogous to a set of ‘books on a shelf.’ Metacognition is the process through which the entrepreneur chooses one of those books over all others. In the case of the example presented above, to study metacognition is to investigate the cognitive process through which the entrepreneur incorporates experiences, intuitions, and knowledge into the formulation of a sense-making strategy given the funding task, ultimately deciding, for example, to pursue angel funding for this particular venture (as opposed to other funding sources).

Research indicates that individuals who are “*metacognitively aware*” are: 1) more likely to recognize the fact that there are multiple cognitive alternatives available to process a given task or situation, 2) more likely to engage in the conscious process of considering those multiple alternatives, and 3) more likely to be sensitized and receptive to feedback from the environment and to incorporate that feedback into subsequent decision frameworks (Melot, 1998; Schraw & Dennison, 1994).

Therefore metacognitive awareness serves to facilitate a state of *cognitive adaptability* consistent with what Ireland et al. describe as an entrepreneurial mindset (2003). In a sense, metacognitive awareness serves as a mechanism that bridges the

divide between the biases embedded in individuals' cognitive mechanisms and a state of cognitive adaptability that facilitates functioning in a dynamic environment. This compensating effect of metacognition may be especially valuable to entrepreneurs because the ability to access different cognitive strategies is particularly valuable in a dynamic and challenging environmental context. For example, Staw and his colleagues demonstrate that employing a metacognitive strategy is positively related to an individual's ability to select the most appropriate/effective strategy to pursue a given goal in light of his or her motivations and environmental context (Staw & Boettger, 1990; Staw et al., 1981).

Metacognition is a learned cognitive process, responsible for controlling the selection of an appropriate cognitive response in light of the characteristics of the situation, the individual, and the cognitive task at hand. Empirical studies indicate that metacognition is separate from other cognitive constraints on learning, such as intelligence, and that an individual's development and application of metacognitive processes cannot be predicted "with even a moderate degree of accuracy" from domain knowledge (Glenberg & Epstein, 1987).

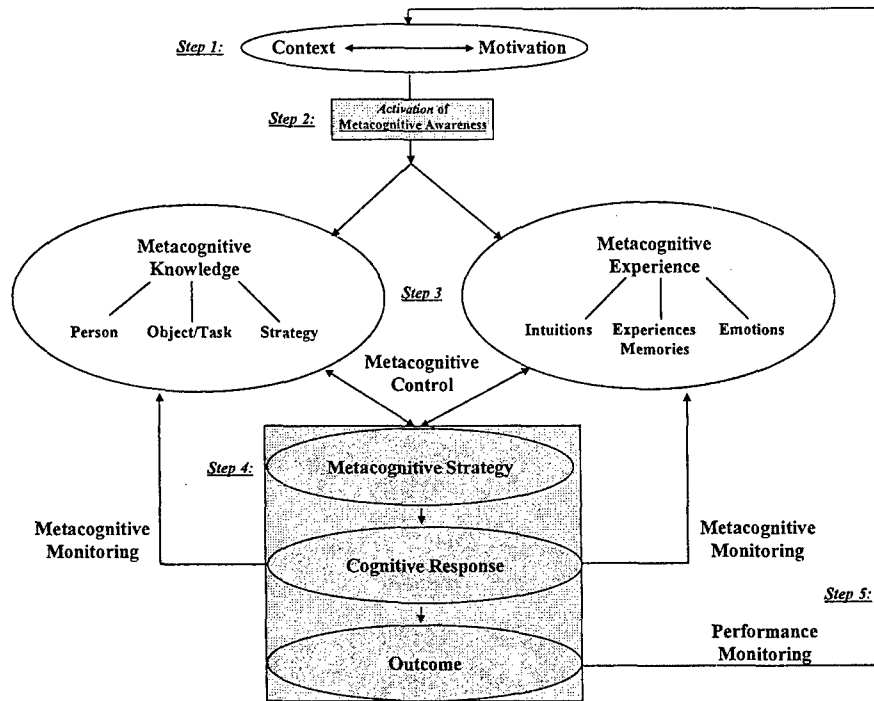
In summary, entrepreneurship is an important phenomenon and exemplifies a context where dynamism and uncertainty are typically high. I propose that metacognition is likely to influence the entrepreneur's development, evolution, and selection of cognitive strategies – promoting cognitive adaptability - and in turn influence entrepreneurial performance across a host of entrepreneurial behaviors and tasks. Entrepreneurial tasks include the discovery, evaluation, and exploitation of opportunities to bring into existence future goods and services (Shane &

Venkataraman, 2000), new entry through the introduction of new products in new or existing markets, the introduction of existing products into new markets (Lumpkin & Dess, 1996), or new firm creation (Gartner, 1988; Sarasvathy, 2001).

Conceptual Model

The conceptual model which is the basis for the hypotheses investigated in this dissertation is presented as Figure 1.1. While it is beyond the scope of this dissertation to empirically investigate all of the relationships depicted in the model, I will briefly describe the entire model for the purposes of developing a comprehensive understanding of the relationship between individual goals and motivations, metacognition, decision-making, and feedback. The model is comprehensively developed in Chapter II of this dissertation, where a series of research propositions are developed and presented. A subset of these propositions are explored further in Chapter III and form the basis of the hypotheses that will be empirically investigated. The methods, results, and implications of this empirical investigation are reported in Chapters IV - VI.

Figure 1.1. Situated Metacognition



The core argument presented in Figure 1.1 is that entrepreneurs perceive, and subsequently assign meaning, to the characteristics of the environment in the context of their own motivations. This interaction, depending on how it is perceived by the individual, may serve to activate an awareness of metacognitive strategies in the context of the environment, motivations, and the cognitive task. These metacognitive strategies regulate cognitive responses (Nelson, 1996; Nelson & Narens, 1984), drawing on metacognitive knowledge and metacognitive experience to elicit strategies to ‘think about thinking’ such as specific types of reasoning, memory retrieval processes, or the accessing of specific schema or heuristics (Schacter, 1996; Wyer & Srull, 1989).

I will discuss this model stepwise based on its five major elements (see Figure 1): Step 1) the interaction of context and motivation; Step 2) the activation of

metacognitive awareness, Step 3) critical metacognitive resources – metacognitive knowledge and metacognitive experiences, Step 4) metacognitive strategies and other responses, and Step 5) monitoring and feedback mechanisms.

It is important to note that I do not mean to imply individuals follow these five steps in some deterministic fashion, but that these processes represent the breadth of activities that may be engaged in by an individual when faced with a cognitive task. Thus, the model represents the complete range of processing potentially available to a person rather than a programmed sequence inevitably followed. Propositions generated from the model are fully developed in Chapter II of this dissertation.

Step 1: The Interaction of Context and Motivation. The top of Figure 1 depicts the relationship between an individual's motives and context. Motives influence how context is perceived and interpreted (Griffin & Ross, 1991; Schacter, 1996). At the same time, context may define an individual's motives (Wyer & Srull, 1989). This interaction, depending on how it is perceived by the individual, serves as the basis for the development and employment of metacognitive strategies focused on satisfying some motivation, or realizing some cognitive outcome.

Step 2: Activation of Metacognitive Awareness. Metacognitive awareness is heightened - or lessened - based on characteristics of the task and an individual's motivational state, and can be considered analogous to the volume of a stereo receiver. Metacognitive awareness refers to the conscious act of engaging in a process of formulating strategies that select among available cognitive responses. In this model – consistent with Flavell (1979) and Narens (1996) – I adopt the assumption that metacognitive awareness (at some level) is indicative of the extent to

which metacognitive resources such as metacognitive experience and knowledge (*Step 3*), and monitoring (*Step 4*) are engaged to elicit some cognitive response (*Step 5*). Therefore metacognitive awareness is representative of the full range of the metacognitive processes available to the individual.

It is important to distinguish the characteristics of the larger context (environment) from those of the cognitive task from which metacognitive awareness arises. I suggest that, although an individual is likely to perceive a given task in the context of the environment/motivation interaction, it is the specific characteristics of the task itself (in terms of risk, novelty, and conflict) and the person's motives (e.g., perceiving the situation as one of flight/threat versus fight/opportunity) that are responsible for "tuning" metacognitive awareness (Flavell, 1979; 1987). For example, the entrepreneur may function in a highly uncertain, risky context, but when applying cognitive resources to a particular task s/he may view that task as not risky/novel/contentious and therefore process that task automatically absent of the development of metacognitive strategy.

Step 3: Metacognitive Resources: Metacognitive Knowledge and Metacognitive Experience. Variability exists between individuals and within individuals across contexts in the extent to which metacognitive processes are used. As noted above, one source of this variability is metacognitive awareness, but another depends upon an individual's metacognitive capabilities – or what I call metacognitive resources. Metacognitive resources help define the scope of a particular problem or situation, given what an individual understands about people, tasks, strategy, themselves (intuitions, emotions, experiences, memories), and their

own cognitive processes. These resources serve a control and regulatory function (see Metacognitive Control in Figure 1). Flavell distinguishes between two types of resources: metacognitive knowledge and metacognitive experiences, which play key roles in the formulation of metacognitive strategies depending in large part upon the task (1987). Both resource types (metacognitive knowledge and metacognitive experience) are developed further in Chapter II.

Step 4: Metacognitive Strategy and Other Responses. When an individual with heightened metacognitive awareness draws upon his/her metacognitive resources, s/he will develop a metacognitive strategy for how to 'think about thinking.' While a cognitive strategy refers to an existing mental method (such as visualization) used to generate some outcome (such as a business's mission statement), metacognitive strategizing refers to the process through which one generates alternative ways for creating cognitive strategies and choosing among them.

Step 5: Monitoring and Feedback. Flavell writes that "while a cognitive strategy is simply one to get the individual to some cognitive goal or sub goal...the purpose [of a metacognitive strategy] is no longer to reach the goal (cognitive strategy), but rather to feel confident that the goal has been accomplished" (1987: 23). Consistent with this perspective, this model includes mechanisms to assess the outcome of a given cognitive response relative to motives, metacognitive knowledge, and metacognitive experience (Flavell, 1979, 1987). Monitoring of an individual's own cognitions can/does occur both during attention to a particular cognitive task (metacognitive monitoring), as well as in response to some cognitive or behavioral outcome (performance monitoring).

Research Question

Given the breadth of the conceptual model developed here, the focus of this dissertation is to specifically investigate the relationship between metacognitive awareness and cognitive adaptability. Generally this focus is captured in the following research question which serves as the basis for my empirical investigation:

Is metacognitive awareness related to an individual's ability to incorporate feedback from the environment in such a way as to effectively and appropriately evolve his/her decision policies in the performance of novel, entrepreneurial tasks?

In order to adequately address this question in a rigorous and comprehensive way, this dissertation project has three primary, empirical aims:

1. To demonstrate that metacognitive awareness can be measured.
2. To test whether metacognition is related to 'cognitive adaptability' in the context of an entrepreneurial task.
3. To test whether cognitive adaptability - *enabled by increased metacognition* - is normatively related to performance on an important entrepreneurial task.

Contributions

Clearly I believe that cognitive research holds great promise in entrepreneurship. Entrepreneurship is commonly defined based on new products, new markets, and new ventures (e.g., Lumpkin and Dess, 1996). As a result, entrepreneurship scholars are most interested in questions focused on opportunity recognition, exploitation, new venture creation, learning, knowledge, and entrepreneurial 'intent.' Cognition, how individuals make sense of their environment, is fundamental to each and every research question cited above. This is a notion not lost on entrepreneurship scholars, as research applying a cognitive lens to these

problems is proliferating exponentially. I would argue, however, that for cognition-based research to flourish and genuinely inform the 'practice' of entrepreneurship, we must begin to open the cognitive black box in such a way as to understand how inputs to cognitive processing, such as the environment, and idiosyncratic goals and motivations, influence performance on important entrepreneurial tasks such as new product development, opportunity recognition, and new venture creation. Consider how entrepreneurship research questions, and the practical implications of that research, become more robust as we dismiss the assumption of homogeneity of context, for example, as an input to cognitive processing.

What is it about how individuals 'differently' make sense of a given environment that results in a varying ability to identify and exploit opportunity? Is it enough, for example, to say that individuals who possess more knowledge identify more opportunities? I'd argue no, and hypothesize that such differences may be due, in part, to differences between entrepreneurs in terms of cognitive adaptability in light of dynamic context.

I assert that situated metacognition – focused on its role in moderating cognitive adaptability - provides a compelling lens to study entrepreneurship. First, the role of cognitive functioning can be examined over the duration of the entrepreneurial process. Metacognition enables us to study the dynamics of making sense of the economic and social environment embedded in a context that begins prior to the identification of the entrepreneurial opportunity, and runs through the many stages and steps associated with exploiting entrepreneurial opportunities. Metacognitive research is consistent with my interest in how context influences what

cognitive strategies are developed and/or identified. Further, metacognition is naturally suited to studying individuals engaged in a series of entrepreneurial processes and examining cognitive processes across entrepreneurial endeavors. Finally, metacognitive processes may be important in dynamic environments. When environmental cues change, individuals adapt their cognitive responses and develop strategies for responding to the environment (Earley, Connolly, & Ekegren, 1989a). Given the dynamism and uncertainty of entrepreneurial contexts, metacognition facilitates studying how entrepreneurs cognitively adapt to their evolving and unfolding context. In the end, this dissertation makes the following two broad contributions.

First from a theoretical perspective, by bringing together literatures from social psychology and metacognition in a model of socially situated metacognition, I offer a robust, testable framework that serves to address two notable shortcomings of the extant entrepreneurial cognition literature: specifically 1) the inadequate treatment of the influences of idiosyncratic goals, motivations, and environmental context on cognitive processing, and 2) the inadequate treatment of the cognitive mechanisms that promote adaptable (rather than inhibit) thinking and cognitive processes in general given a dynamic environment. Why is it that entrepreneurs 'think' differently about a given entrepreneurial task (and subsequently behave differently)? The model proposed here suggests that this difference is not necessarily due to inherent differences in entrepreneurs in cognitive ability or process, but to the conjoint influences of an individual's motivation and context which, in turn, may result in disparate cognitive strategies employed to realize some outcome. This framework

represents an important step forward towards realizing the stated goal of many entrepreneurship scholars, that is to 'open the back box' of entrepreneurial cognition such that we can fully understand the relationship between cognition and performance in an entrepreneurial environment.

Second, by empirically investigating a series of means-ends relationships proposed by the theoretical model – specifically how monitoring of ones own cognitions relates to performance on an entrepreneurial task – I demonstrate the utility of the model as a framework to be applied to the study of entrepreneurial cognitions. More significantly, my findings suggest that normative differences in performance on entrepreneurial tasks may be explained by the role that metacognition plays in promoting cognitive adaptability.

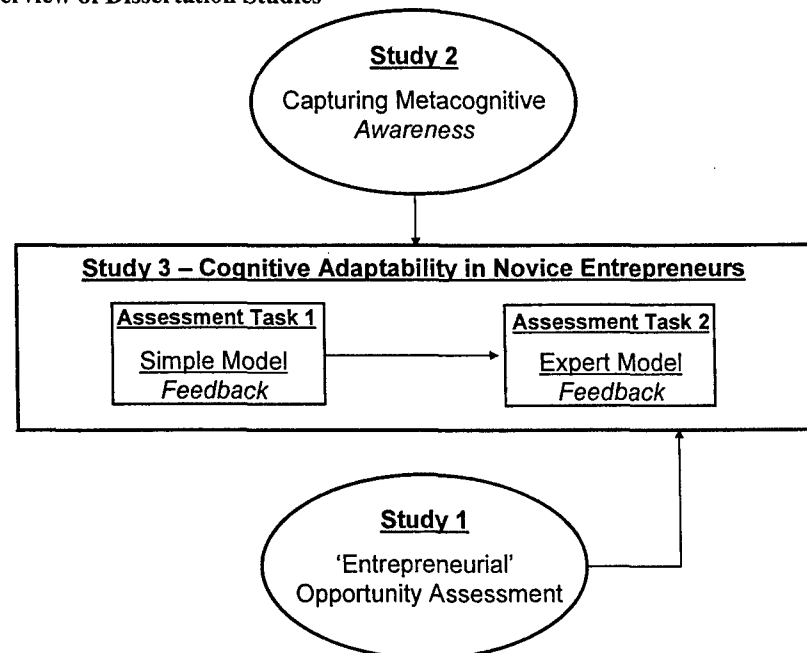
Research has established that cognitive feedback – feedback which provides the decision-maker with information that relates his/her own decisions with information about the decision task and the environment – is effective in promoting subsequent learning and normative improvements in decision-making (Blazer et al., 1994). It is my aim, however, to demonstrate that the benefits of cognitive feedback are enhanced for those individuals who are highly metacognitively aware. Put simply, given the tenants of the model of situated cognition developed in this dissertation, I suggest that these individuals (highly metacognitively aware) use cognitive feedback more effectively than individuals who are less metacognitively aware, and subsequently perform better on novel decision tasks. I test whether, as the conceptual model suggests, metacognition is related to promoting cognitive

adaptability, and whether cognitive adaptability is normatively related to performance on an entrepreneurial task.

Overview of Studies and Methods

This dissertation proposes a new lens focused on how individuals develop and inform metacognitive cognitive strategies responsible for regulating cognitive functioning and promoting *cognitive adaptability*. Metacognitive strategies, if employed, promote a state of cognitive adaptability I propose to be positively related to effective decision-making in the context of an entrepreneurial environment characterized by dynamism and uncertainty. To investigate the role of metacognition in promoting cognitive adaptability, this dissertation consists of three (inter-linked) studies. The relationship between these studies is depicted below in figure 1.2.

Figure 1.2. Overview of Dissertation Studies



In *Study #1*, I model and decompose the 'opportunity assessment' decision policies of a sample of entrepreneurs. In modeling the decision policies of

entrepreneurs, I use conjoint analysis to capture 2,336 entrepreneurial decisions nested within a sample of 73 entrepreneurs. Conjoint analysis is a “technique that requires respondents to make a series of judgments, assessments or preference choices, based on profiles from which their ‘captured’ decision processes can be decomposed into its underlying structure” (Shepherd & Zacharakis, 1997: 207). This study, and the decision-making framework that results, will become the foundation for Study 3.

In *Study # 2*, I develop and validate a measure of metacognitive awareness consistent with the conceptual model of situated metacognition introduced in this chapter. This measure was constructed to capture *the extent to which individuals differ in their engagement of metacognitive strategies - employing metacognitive resources (Step 3) and monitoring of their own cognitions (Step 4) - based on their own idiosyncratic goals and motivations (Step 1)*. The construct validation of the metacognitive awareness scale employs factor analysis techniques in a way consistent with the recommendations of Reis and Judd (2000). Like Study # 1, the instrument developed here is the basis for capturing changes in metacognitive awareness in the context of Study 3.

In *Study #3*, I model the decision policies of a sample of inexperienced entrepreneurs. Specifically, across four, inter-linked conjoint studies I capture the decisions of a sample of 217 individuals engaged in an entrepreneurial task. Manipulations focused on the nature of decision feedback (outcome vs. cognitive feedback) characterize this experiment. Individuals are trained in a ‘simple model’ of opportunity assessment, creating a learned decision policy focused on assessing the

attractiveness of entrepreneurial opportunities. The extent to which this 'simple model' is internalized and employed in opportunity assessment will be determined using conjoint analysis and hierarchical linear modeling (HLM) procedures. Subjects then engage in a second opportunity assessment exercise, where they receive real-time feedback (outcome or cognitive feedback generated from a computer software program designed specifically for this experiment) focused on migrating their decision policies away from the initially learned, simple model of opportunity assessment and towards the decision policies of the expert entrepreneurs (expert model) captured in Study #1. The evolution of decision policies - and the role of metacognition and feedback in inhibiting or promoting cognitive adaptability - will be captured using conjoint analysis and hierarchical regression.

Summary

The remainder of the dissertation proceeds as follows:

Chapter 2 — I provide a review of the literature covering the major areas and perspectives that are combined in this dissertation, and I develop more fully the model of situated metacognition introduced in this chapter. My model suggests that metacognition is related to promoting cognitive adaptability in complex environments. I conclude this chapter with a brief, integrative summary of the literature as it relates to the research questions I propose to investigate in this dissertation.

Chapter 3 — I present the theoretical foundation and development of a set of research hypotheses focused on the main effect and contingent relationships between

metacognition, feedback, and my dependent variable - cognitive adaptability –given an entrepreneurial task.

Chapter 4 — I detail the research method for empirically testing the hypotheses developed in Chapter III. Each of the three studies is discussed individually in terms of the sample, design, variables, and methods employed. Given that the studies are complementary and build upon each other in such a way as to comprehensively address my research questions, this section concludes with an integrative discussion of the three studies as well as a discussion of the potential limitations of this research.

Chapter 5 — I report the research findings for each of the three studies which make up this body of work. Each study is reported individually, and the findings are then integrated in the subsequent chapter.

Chapter 6 — I conclude with a review, discussion, and integration of the results from each of the three studies in the context of the major research question, and a discussion of the contributions of the research to the entrepreneurship and strategic management literatures. This chapter ends with a conclusion about the research in this dissertation.

CHAPTER TWO

COGNITIVE ADAPTABILITY THROUGH SITUATED METACOGNITION¹

Overview

In this section I will examine literature from each of the major domains of research which contribute the theoretical foundations of this dissertation. I begin with a general discussion of the origins of social cognitive theory - focusing on a '*situated cognition*' framework and the complementary dual-process model of cognitive functioning. Then in the context of situated cognition, I will discuss the extant cognition literature in the area of entrepreneurship. Finally, I will further develop the model of situated metacognition described in Chapter I in the context of cognitive adaptability, and subsequently explore the implications of a metacognitive model for entrepreneurship research.

Acknowledging that these literatures – specifically social cognition and metacognition – are extensive, my review must be selective. My focus is on those areas within each of these domains of academic inquiry which directly relate to the research question posed in Chapter I.

Social Cognition – Its Origins and Evolution

Introduction

To study social cognition is to study the process through which “people make sense of the environment, other people, and themselves” (Fiske & Taylor, 1991). In

¹ The ideas in this chapter were initially developed by me for this dissertation, however in the process of developing this chapter into a paper to be submitted for publication, these ideas have benefited greatly from the input of my co-authors: Professors Elaine Mosakowski, Dean Shepherd, and P. Christopher Earley.

this sub-section I will generally describe the origins of social cognition as a domain of research focused on cognition as a dynamic *process*. I will describe the ‘situated cognition’ framework and the accompanying ‘dual-process’ model of social cognition as representative of a generally agreed upon framework which has become the focus of modern social cognition research. I will this conclude this sub-section with a simple conceptual framework which depicts the dual-process model of social cognition, as it was this model which served as the basis for the development of the model of situated metacognition described in Chapter 1 of this dissertation.

The Origins of Social Cognition in Social Psychology

The study of human cognition - how humans learn, acquire knowledge, and apply that knowledge to solve problems – has been the subject of thoughtful research since the time of Aristotle. Generally two approaches to the study human cognition have dominated the last century of theoretical and methodological development: the Elemental and Holistic approaches.

Those who subscribe to the “Elemental” approach describe the study of the mind as being akin to the study of chemistry, where ideas, memories, and attributions are analogous to elements. Individual elements (e.g. memories) are associated with other elements (e.g. attributions) to facilitate cognition and sense-making (Hume, 1739, Hartley, 1749, Mills, 1843). Today this approach dominates the domain of cognitive science research.

The “Holistic” approach to studying human cognition has its origins with Kant (1781). Kant argued for studying the mind holistically because ‘perception is furnished by the mind and is not inherent in the stimulus.’ Gestalt psychology

adopted this perspective, and Lewin (1951) brought these ideas into *social psychology* emphasizing the environment as perceived by the individual with an emphasis on the total situation (Koffka, 1935; Kohler, 1938). These ideas represent the origins of social cognition and a domain of inquiry and research within social psychology.

From its very beginning, scholars working in the field of social psychology have focused on “the cognitive and mental processes that underlie human social behavior” (Manis, 1977; Operario & Fiske, 1999). Fiske and Taylor write that research in social cognition shares three basic features: a commitment to mentalistic interpretations, a commitment to process analysis, and cross-fertilization between cognitive and social psychology (1991). At the core of social cognition research is the idea that the individual exists within a *psychological field* composed of two component pairs. Pair 1 describes the *person-situation*. The *person* brings values, beliefs, and perceptions which act on the environment (*situation*) to constitute the field. The second pair of factors cuts across this field to determine behavior, and consists of *cognition-motivation*. Cognition contributes the person’s interpretation of the world, and motivation (its strength) predicts whether behavior will occur (Lewin, 1951). While the dominant theoretical paradigms around which scholars have based social cognitive research evolved through improvements in neuroscience, technology, advances in linguistics, memory systems, and research methodologies, the widespread use of the computer in the late 1960s fundamentally altered the focus of cognition research and spawned the “Cognitive Revolution.”

Cognitive social psychologists began to adopt the metaphor of human beings as processors of information being akin to computers, processing in response to

stimuli from a social context (input). Given this metaphor, the task of a psychologist in understanding human cognition became “analogous to that of a man trying to discover how a computer has been programmed” (Neisser, 1966). In that vein, Neisser went on to define cognitions as the processes through which sensory input is transformed, reduced, elaborated, stored, recovered, and used (1966). Individuals became characterized as isolated processors of information, and this overarching framework spawned several conceptualizations of how humans process their environments that dominated social cognition research up until the late 1980s. Generally, these conceptualizations are described as follows:

- The individual as a *Consistency Seeker*: proposed that individuals are motivated to resolve perceived discrepancies between cognitions (Heider, 1958).
- The individual as a *Naïve Scientist*: proposed that given time, people will gather data and arrive at a logical conclusion (Fischhoff, 1976).
- The individual as *Cognitive Miser*: proposed that individuals are limited in their processing capacity, so they take short-cuts where they can (Taylor, 1981).

Social Cognition – An Evolving Paradigm

While social psychologists imported many of the ideas described above from cognitive science, today prominent psychologists argue that the field may have carried the *computer metaphor* of human cognition too far. These psychologists argue that it is time to modify or discard the information processing paradigm to allow for an interaction between individual cognition and the social/environmental context. Schneider poses the question “Where, oh where, is the social in social cognition?” (1991: 553).

Among others, Schwarz cites the need for more inclusive models of human cognition within social psychology (Operario & Fiske, 1999; Schwarz, 1998a). Schwarz notes that “the computer metaphor, around which models of information processing are built, constrained the range of phenomena addressed by cognitive social psychologists” (Schwarz, 1998a: 240). Specifically he acknowledges that these models (1) do not “easily lend [themselves] to investigations of emotional and motivational influences on human cognition and behavior and hence fostered a neglect of “warm” cognition in favor of an emphasis on “cold” cognition,” and (2) these models “fostered a neglect of the social context in which humans do much of their thinking” (1998a: 241).

This dissatisfaction has motivated research into what has been termed “situated cognition,” a framework that suggests that individuals’ patterns of cognition adapt in response to environmental context, and that individuals’ motivational factors influence *how* individuals make sense of a given situation, task, or person. This reorientation of cognitive research represents a meaningful divergence from the information processing paradigm that dominated cognitive science during the 1970’s through the early 1990’s (Schwarz, 1998a; Tetlock, 1990). Consistent with the situated cognition framework is the conceptualization of the individual ‘thinker’ as a “Motivated Tactician.” The *Motivated Tactician* framework describes the individual as a fully engaged thinker who has available multiple cognitive strategies, and selects among those strategies based on idiosyncratic goals, motives, and needs (Fiske & Taylor, 1991; Tetlock, 1990, Showers & Cantor, 1985).

Operario and Fiske note that contemporary research within cognitive social psychology has “abandoned a uni-dimensional view of social thinkers, now treating them as complicated entities who bring their own values, experiences, knowledge structures, and personal motivations to social perception and interaction. Empirical studies now examine specific variables that inhibit or propel people’s thought processes, rather than simply documenting their inherent cognitive defects (Operario & Fiske, 1999).” This conceptualization of situated cognition – particularly the idea that individuals have available multiple cognitive strategies to apply to a given task or situation - represents one of the theoretical foundations for my conceptualization of cognitive adaptability. Therefore, in the next section I will briefly describe the cognitive process given a situated cognition framework.

Situated Cognition and the ‘Dual-Process’ Model

Taylor writes that “independent of their theoretical orientations, social psychologists agree...that individual behavior is strongly influenced by the environment, especially the social environment...the person does not function in an individualistic vacuum, but in a social context that influences thought, feeling, and action” (1997). The situated view of cognition is based on the premise that the basis for knowledge comes from how the actor interacts with people and situations. Fundamental to understanding cognition, proponents of situated cognition assert, is to understand the goals, emotions, and motivations of the individual actor within the context of the situation. It is impossible to separate the actor from the context, in that the actor constructs mental maps to facilitate reasoning based on inputs from the environment. Learning is defined as the ability to find and use resources within the

context of the environment, and knowledge is acquired through the internal processes of the actor as he/she perceives and interacts with the environment (Greeno, 1991).

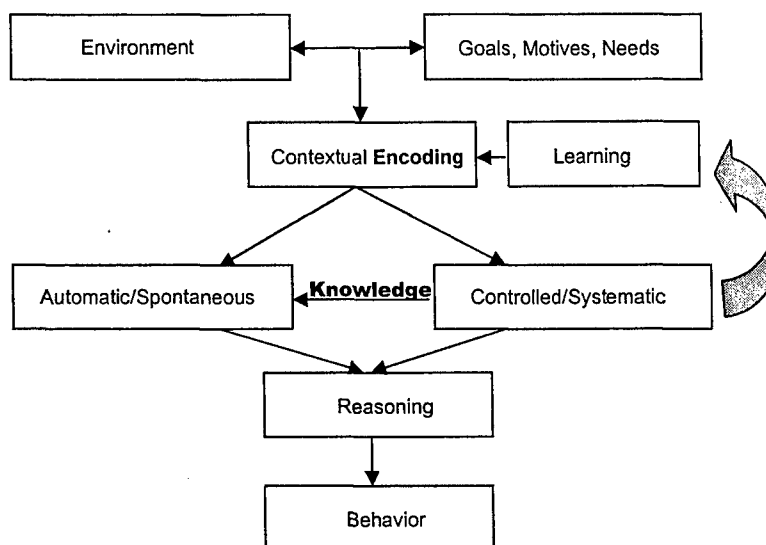
Given the situated cognition frame described above, consider the cognitive process: In the context of making sense of a situation or task, the first step in the cognitive process is *encoding*. Encoding is the mechanism through which individuals create mental representations of their environment. Encoding is an instantaneous process that occurs on a non-conscious level. Consider encoding akin to taking a mental snapshot, and then assigning meaning to what you see in the picture. Links to prior knowledge are established allowing for the development of inferences. Not all elements representative of the environment are considered equally. In effect individuals may be 'sensitized' to certain elements or characteristics of this mental picture more than others. This facet of encoding describes the degree to which a particular environmental characteristic is *salient*, and therefore afforded consideration in the encoding process.

Different characteristics may be more or less salient to different individuals as they perceive the same environment. Given a situated cognition frame, the saliency of environmental characteristics is, to a large extent, a function of the needs, goals, and motivations of the perceiver. More to the point, environmental characteristics will be afforded more or less attention (assigned more or less significance) in the encoding process (saliency) based on the degree to which those characteristics impact the goals, motives, and needs of the perceiver. The encoding process facilitates cognition.

People will respond cognitively (processing) to the mental representation they have created of the environment in a schema-driven (automatic/spontaneous) or a more data-gathering (controlled/systematic) mode as a *function* of the strength of individual goals and motivations given a particular task or situation. Cognition therefore becomes a 'dual-process' function composed of an "automatic/spontaneous" element and a "controlled/systematic" element. The **automatic subsystem** is defined by schema, and is conceptually driven as a 'top-down' approach to sense-making. The **controlled subsystem** is 'bottom-up,' data driven process. Learning becomes the ability to find and use resources within the context of the environment (saliency), and "fine tunes" the individual's ability to appropriately encode the environment in the context of his or her goals, motives, and needs. The selection of which cognitive 'subsystem' to employ relates, in large part, to the consequences of 'being wrong' as perceived by the individual. Generally, those factors that increase the cost of being wrong will drive people to employ data-driven strategies (Fiske & Taylor, 1991). In this context it is important to stress that the "cost" of being wrong is a function of the perceiver's goals, motives, and needs. When the cost of being wrong is low, the 'thinker' will function as a 'cognitive miser' and employ cognitive short-cuts such as schema or scripts.

Knowledge is acquired as the individual cognitively processes the relationship between the environment and his/her goals, motives, and needs by employing the data driven sub-system. New schemas are created and existing schema are re-defined as a result of this process. The model depicted below is representative of the relationships described above:

Figure 2.1. Situated Cognition – A Dual Process Model



The focus of the process depicted in Figure 2, which is of the type that Tetlock characterizes as a 'Fourth Generation' model of social cognition, is to investigate 'what types of machines people become when confronted with particular types of tasks of particular types of environments (Tetlock, 1990)'. The focus of contemporary social cognition research has shifted toward a "warmer, more social" frame where the interaction between an individual's idiosyncratic motivations and the environment are central in understanding the cognitive process (Schwarz, 1998).

Given this overview, in the next section I will review that state of cognitively-orientated work within the larger domain of entrepreneurship research.

Cognition and Entrepreneurship

Cognitive research on "situated cognition" suggests that individuals' patterns of cognition adapt in response to environmental contexts, and that individuals' motivational factors influence *how* individuals make sense of a given situation, task, or person. As noted above, many prominent psychologists have embraced a situated

cognition perspective because it has been suggested that the field has carried the *computer metaphor* of human cognition too far and that it is time to adapt or discard the information processing paradigm to allow for an interaction between individual cognition and the social/environmental context (Schwarz, 1998a; Tetlock, 1990).

It is noteworthy that interest in cognition among entrepreneurship scholars has come at a time when social and cognitive psychologists are engaged in such a fundamental re-orientation of their core theoretical assumptions and frameworks. I suggest here that much of the cognition-focused work in entrepreneurship draws from the same models and theoretical assumptions that Schwarz and his colleagues cite as constraining robust, generalizable research. For example models based on scripts, heuristics, and decision biases depend implicitly upon the consistency of information processing across settings, and emphasize cognitive mechanisms for conserving limited cognitive resources.

Although we might envision abstract cognitive processes like reasoning as devoid of context, research found that different forms of reasoning vary in their domain specificity (Markman & Gentner, 2001). Further, psychological research demonstrates that individual motivations influence the development and selection of cognitive strategies (Earley *et al.*, 1989a; Kahneman, 1973; Staw & Boettger, 1990), such that certain motivational states activate specific cognitive interpretations (e.g., opportunity for creating new business opportunities) based on characteristics of the context (Schacter, 1996). As with the influences of context on cognition, models based on the constrained ability of individuals to process information do not lend themselves to the investigation of the influences of motivation on cognition (Schwarz,

1998). Therefore, consistent with Schwarz and others, I suggest that models based primarily on individuals' constrained information processing capabilities are limited in their ability to address the dynamic interplay of entrepreneurial context, individual thought, and human motivations from which important entrepreneurial outcomes such as, for example, innovation and opportunity identification may result. To investigate the treatment of context and motivation on cognition in entrepreneurship, I conducted a review of the extant entrepreneurship literature focused on research purporting to examine the role of cognition in the entrepreneurial process. Table 2 lists a sample of empirical articles published in scholarly journals within the last sixteen years that apply a cognitive lens to entrepreneurial behavior. The articles included in this review are exclusively empirical, and were identified as empirical "based on some sort of data and data analysis" (Chandler & Lyon, 2001).

I identified articles with keyword searches of the Business Source Premier (BSP) and ABI/Inform databases, and included in my review only articles that the authors *themselves* identified as focused both on cognition and entrepreneurship. The keyword search procedure was exhaustive; I searched both databases with every possible combination and variant of the words 'cognition' and 'entrepreneur.' Additional searches of both databases were performed pairing all variants of 'entrepreneur' with the most commonly researched cognitive mechanisms, specifically 'schema,' 'heuristic,' and 'script.' I restricted my search to: Journal of Management, Strategic Management Journal, Journal of Applied Behavioral Science, Journal of Business Venturing, Academy of Management Journal, Entrepreneurship Theory and Practice, Management Science, and Organization Science.

My search procedures produced 18 empirical articles published in the above journals since 1987 and identified by the authors as incorporating cognition and entrepreneurship and were classified as empirical based on Chandler and Lyon's (2001) definition. This population of 18 empirical articles was further refined. First, some articles discussing cognition employed cognitive theory only tangentially or the study focused on venture capitalists or actors other than the entrepreneur. These articles were excluded. Also, construct validation studies were removed. My screening criteria resulted in 10 empirical articles deemed appropriate. In the following two subsections, I review the resulting cognitive research with regard to two themes: 1) how context is studied, and 2) whether an individual's motivational states are considered in the pursuit of some entrepreneurial outcome. I focus on empirical, cognitively-oriented entrepreneurship research to examine both *if and how* context is examined in the entrepreneurship literature.

To describe the methodological approaches to studying relations among context, motivation, and cognition, I categorized articles based on: 1) whether the author(s) sampled entrepreneurs operating in a homogeneous or heterogeneous context, 2) whether the author(s) incorporated contextual differences in their analytical approaches (model and/or study design) versus either ignoring *or controlling* for those differences, 3) whether contextual characteristics were defined objectively versus subjectively, and 4) whether contextual characteristics were incorporated as independent or control variables.

Table 2.1. Entrepreneurship and Cognition

<u>Study</u>	<u>Purpose</u>	<u>Sample</u> *	<u>Analytical Treatment of Context</u> * ^b	<u>Context Defined</u> * ^c	<u>Independent V. Control</u> * ^d
Keh, Foo & Lim, 2002	uses a cognitive approach to examine opportunity evaluation	Heterogeneous	Ignored	Ignored	Ignored
Lau & Busenitz, 2001	employs a model of entrepreneurial cognition to test the influence of social context, personal factors, and cognition of Chinese entrepreneurs on growth intentions and method of expansion	Heterogeneous	Considered	Objectively	Independent
Busenitz, 1999	the author proposes that entrepreneurial risk can be explained by recognizing that entrepreneurs use biases and heuristics more, which may lead them to perceive less risk	Heterogeneous	Ignored	N/A	N/A
Markman, Balkin & Baron, 2002	considers two individual differences - general self-efficacy and regretful thinking - in the context of technological innovation and the propensity to start a new venture	Homogeneous	Considered	Subjective	Independent
Mitchell et al., 2002	explores entrepreneurial cognitions by considering differences across cultures	Heterogeneous	Considered (sampled)	Objective & Subjective	Independent
Mitchell, Smith, Seawright & Morse, 2000	the authors propose and find support for a cross-cultural, cognitive model of venture creation	Heterogeneous	Considered	Subjective	Independent
Busenitz & Barney, 1997	examines differences in the decision-making processes used by entrepreneurs and managers in large organizations	Heterogeneous	Considered	Subjective	Control
Simon, Houghton, Aquino, 1999	explores how individuals cope with the risks inherent in their decisions, and suggests that entrepreneurs may not perceive the risk of starting ventures	Homogeneous	Ignored	N/A	N/A
Palich & Bagby, 1995	employs social cognition framework in an attempt to differentiate entrepreneurs from others while predicting differences in risk-taking behavior	Heterogeneous	Ignored	N/A	N/A
Gatewood, Shaver & Gardner, 1995	explored whether cognitive factors of entrepreneurs can be used to predict their subsequent persistence in new venture creation	Heterogeneous	Ignored	N/A	N/A

Context

As Table 1 indicates, 8 of the 10 studies draw upon contextually diverse samples, yet half of that group ignores these differences in their analytical approach. Although it may be reasonable to assume that, for example, some degree of risk and environmental uncertainty is generalizable within any entrepreneurial context, the nature and extent of uncertainty likely varies across industries, sectors, and even within the opportunity pursued by the entrepreneur. When considering how measures of context relate to individual perceptions, I propose that those relationships are meaningful to the development of theories of entrepreneurial cognition and therefore empirical research should seek variance in these measures across the sample. Only a

select few studies incorporate specific aspects of contextual differences in theoretically meaningful ways into their analysis – most only attempt to control for context as opposed to capturing measures of contextual heterogeneity as independent variables. What is promising is that when the influences of specific environmental characteristics are studied, perceptual, subjective measures are most often used. Although I do not equate cognition with perception or suggest that objective measures of context are inappropriate or necessarily misleading, researchers interested in contextual influences on cognition should capture context as it is perceived by the individual. For example, objective measures of uncertainty may rank the bio-tech industry as very uncertain; yet an entrepreneur accustomed to this context may not perceive it as such.

As Table 1 illustrates, few studies situate cognitive processes within the entrepreneurial context in a way that details how context influences cognition, both theoretically and methodologically. In the next subsection, I review the role that an individual's motivational factors play in cognitively oriented research on entrepreneurship.

Differences in Motivational Factors

Psychological research demonstrates that individual motivations influence the development and selection of cognitive strategies (Earley *et al.*, 1989a; Kahneman, 1973; Staw & Boettger, 1990). To categorize how individual variations in motivation (Locke & Latham, 1990) were incorporated into cognitive research, we reviewed the studies in Table 1 using similar classification criteria employed for environmental differences but adapted to motivational differences. As noted previously, the results

of that review indicate that samples of entrepreneurs in cognitively-oriented research are typically quite heterogeneous, yet heterogeneity in individual motivations was not incorporated in any methodological way. It is not an overstatement to say that individual differences in motivations relating to entrepreneurial cognitions were largely overlooked.

In the end, I identify two principal limitations in extant research: little attention is devoted to how context influences cognition, and virtually no attention is paid to how differences in individuals' motivation influence cognitive processing at the level of the individual entrepreneur. As previously discussed, similar limitations within social and cognitive psychological research have led psychologists to develop models that "situate" cognitive functioning within the context of the environment, and to describe individuals as cognitively motivated tacticians - individuals with multiple cognitive strategies available to bring to bear on a given problem, task, or situation (Fiske & Taylor, 1991). What continues to be absent in the discussion is what gives rise to these differing responses. Put simply, what are the antecedents of cognitive adaptability implied by the situated cognition/motivated tactician framework?

In the next section I build upon recent psychological research on metacognition to suggest an answer to that question. Specifically I propose a model of *situated metacognition* – based on the integration of work in social and cognitive psychology - that is the basis for the conceptual model proposed and tested in this dissertation.

Metacognition and Cognitive Adaptability

Overview

Put simply, metacognition refers to 'thinking about thinking.' Individuals vary in their propensity to engage in metacognition (Allen & Armour-Thomas, 1993), and there is evidence that it can be taught (Schmidt & Ford, 2003). Both the education and psychology literatures link the ability to regulate metacognitive processes to creativity and the cognitive application of knowledge (Schraw, 1998; Schraw, 1995). These same literatures also suggest that individuals who access metacognitive processes are more adaptable given dynamic and uncertain contexts (Earley & Ang, 2003), which can translate into superior performance (Garner & Alexander, 1989).

It is the purpose of this review to explore the literature on metacognition as a theoretical integration of conceptualizations grounded in both cognitive and *social* psychology. Therefore, I will begin with a discussion as to the reasonableness of 'situating' metacognitive processes within the social environment, and move to discuss the implications of this perspective on metacognitive functioning and cognitive adaptability. I will then, in a way consistent with my conceptual model of metacognitive functioning, provide an overview of the literature focused on Metacognitive Awareness as it relates to four dimensions of the metacognitive process: *Metacognitive Knowledge*, *Metacognitive Experience*, *Metacognitive Control*, and *Metacognitive Monitoring*. Propositions are presented to fully develop the implications of my model.

Socially Situated Metacognition

Exploring metacognition in the spirit of a mechanism to bridge cognitive and social psychology, Jost, Kruglanski, and Nelson write that the “contents and origins of metacognition are inherently social; at the same time, metacognitions are comprised of cognitive elements and are governed by the principles and laws applicable to human thinking in general (1998: 137). Allen and Armour-Thomas (1993: 204) note that cognitive processes “emerge, develop, and are displayed within a socio-cultural milieu... [and that] contextual forces serve a socializing function in shaping the development and deployment of mental processes in ways that facilitate or constrain task performance.” It is “meaningless to ask a question about any type of thinking without asking concomitant questions about contextual forces in which such thinking is situated” (Allen & Armour-Thomas, 1993: 204).

Walter Mischel describes the evolution of metacognition as research at the “hyphen” of cognitive and social psychology, and develops this premise in the context of the contributions made by Schachter and Tversky to their respective disciplines. Mischel writes that the work of Schachter and Tversky “addressed two questions in one breath: first, the mechanisms and constraints of the mind as people deal with problems that require thinking, judgment, and remembering; and second, how the problem solver tries to make sense of what is happening within the situation under uncertain conditions that characteristically prevail in life – and that clever experiments capture for a moment” (Mischel, 1998: 84). Mischel notes both Schachter and Tversky “forged a bridge” between cognitive and social psychology,

opening the door to explore jointly how people think, and how people interpret a situation based on their own motivations.

Metacognition is consistent with Fiske and Taylor's (1991) emphasis on multiple cognitive strategies. Metacognitive research specifies a cognitive hierarchy, with metacognition being less content-specific and operating at a higher level, and cognitive strategies being more content-specific and operating at a lower level. The perceived appropriateness of a specific cognitive response depends both on an individual's goal-related motivation and on his/her desire to understand the environment (Flavell, 1979). An individual thinks as a cognitively 'motivated tactician,' representative of "a fully engaged thinker who has multiple cognitive strategies available, and chooses among them based on goals, motives, needs" (Fiske & Taylor, 1991: 13). This description focuses the study of cognition on *how and why* an actor interacts with people and situations (Suchman, 1987). Proponents of this view and similarly inclusive frameworks assert that it is impossible to separate the actor from the context, because the actor constructs mental models that facilitate reasoning based on motivations and inputs from the environment (Tetlock, 1990).

That motivation influences cognitive processing is not novel to social cognitive psychology. For example, Wyer and Srull's 'Storage Bin Model' (1989) depicts a "goal specification box," which determines what goal is underlying a given situation (e.g., making a social judgment, general comprehension). Wyer and Srull (1989) suggested that the motivation one has in processing information has a strong effect on its use and implications similar to the point made by Schacter (1996) among others. Motives influence how context is perceived and interpreted (Griffin & Ross,

1991; Schacter, 1996). At the same time, context may define an individual's motives (Wyer & Srull, 1989). This interaction serves as the basis for the development and employment of metacognitive strategies focused on satisfying some motivation, or realizing some cognitive outcome.

I propose that to explore the origins of metacognition and ultimately some more proximate cognitive response rigorously, it is imperative that to conceptualize people as "dynamic, flexible, self-regulating creatures who are sensitive to variations in their social and physical environments and who plan and implement a wide variety of personal and social goals for the purpose of understanding and changing reality" (Jost, Kruglanski & Nelson, 1998: 138). As such, the model (Figure 1, Chapter 1) describes cognitive processing as originating from the conjoint effects of 1) the context in which the individual functions, and 2) the individual motivations of the individual through which context is interpreted. This interaction between motivation and context is subsequently 'enacted' through a metacognitive strategy which complements the individual's perception of the environment in light of his/her own motives. Thus,

Proposition 1: *Motivation and perceived context conjointly impact the process of formulating strategies that select among available cognitive mechanisms.*

Metacognitive Awareness

The extent of metacognitive processing engaged in by an individual, in turn, depends upon his or her level of metacognitive awareness. Metacognitive awareness refers to the conscious act of engaging in a process of formulating strategies that select among available cognitive responses. Metacognitive awareness is heightened – or lessened – based on characteristics of the task and an individual's motivational

states and can be considered analogous to the volume of a stereo receiver. Consistent with Flavell (1979) and Narens (1996) – I adopt the assumption that metacognitive awareness (at some level) is indicative of the extent to which metacognitive resources such as metacognitive experience and knowledge (*Step 3*), and monitoring (*Step 4*) are engaged to elicit some cognitive response (*Step 5*). Therefore metacognitive awareness is representative of the full range of metacognitive process available to the individual. It is important to distinguish the characteristics of the larger context (environment) from those of the cognitive task from which metacognitive awareness arises. We propose that, although an individual is likely to perceive a given task in the context of the environment/motivation interaction, it is the specific characteristics of the task itself (in terms of risk, novelty, and conflict) and the person's motives (e.g., perceiving the situation as one of flight/threat versus fight/opportunity) that are responsible for "tuning" metacognitive awareness (Flavell, 1979; 1987). For example, the entrepreneur may function in a highly uncertain, risky context, but when applying cognitive recourses to a particular task s/he may view that task as not risky/novel/contentious and therefore process that task automatically, absent of the development of metacognitive strategy.

Consider Kahneman's Resource Attention Model (1973). Kahneman notes that: 1) task demands guide the allocation of attentional resources to specific aspects of a task; and, 2) arousal can increase the pool of attention available for task engagement. Similarly, we argue that an individual is more likely to employ metacognitive processing in contexts that stimulate metacognitive awareness than in contexts than are less stimulating (in terms of metacognitive awareness). In addition,

we argue that an individual with higher metacognitive awareness (arousal) is more likely to employ metacognitive processes than someone having a lower level of metacognitive awareness. Therefore, the relationship between metacognitive awareness and outcome performance depends on the context. Thus,

Proposition 2: *The more that context motivates, the greater the metacognitive awareness.*

Proposition 3: *The higher the metacognitive awareness, the greater the reliance on metacognitive knowledge and metacognitive experience in formulating strategies that select among available cognitive responses.*

Metacognitive Resources

Metacognitive Knowledge: Metacognitive knowledge refers to one's conscious understanding of cognitive matters as they relate to 1) people, 2) tasks, and 3) strategy (Flavell, 1987). Metacognitive knowledge of *people* reflects perceptions about how people think. Examples include a belief that one is good at dealing with the "hard" numbers of a business and less competent in the "softer" tasks of human resource management (intra-individual), a belief about how another person thinks (inter-individual), and knowledge that people make mistakes in their thinking (universal). Metacognitive knowledge of *tasks* refers to the nature of information acquired by an individual given a task at hand. Metacognitive knowledge of *tasks*, in turn, influences how information is used in various contexts. An entrepreneur may be asked to review a business plan to evaluate an investment opportunity, and its text is unique and densely packed requiring a considerable investment of time for full comprehension. Less time will be invested when the same entrepreneur reviews the business plan for a university's business plan competition, since this activity is not recognized as significant and is less challenging. Metacognitive knowledge of

strategy refers to procedures for ensuring that a cognitive strategy is appropriate for achieving some desired goal. The selection of a metacognitive strategy incorporates metacognitive knowledge of people and tasks. For the example of an entrepreneur reviewing a business plan with unique and tightly packed information, metacognitive knowledge of strategy might lead the entrepreneur to skim the material briefly to decide the best procedure for assessing the business opportunity given what he or she knows, for example, about the market or the technology (e.g., first, evaluate the top management team; second, search the financial statements for “fatal flaws”, etc.).

Metacognitive Experience: The second type of metacognitive resource, metacognitive experience, are experiences that are affective, based on cognitive activity, and serve as a conduit through which previous *experiences, memories, intuitions, and emotions* may be employed as resources given the process of making sense of a given task, problem, or situation (Flavell, 1987). For example, a person has a metacognitive experience if he has the feeling that something is hard to do or comprehend. Likewise, metacognitive experiences occur if the individual perceives that he or she is failing at some cognitive task, or if one has the feeling that a goal is difficult to attain. Another example is a feeling of knowing how some set of actions is likely to evolve. These experiences arise in everyday life, and are more easily interpreted with age and experience (Flavell, 1987). Metacognitive experiences allow individuals to better interpret their social world (Earley & Ang, 2003) and therefore, along with metacognitive knowledge, control an individual’s cognitive response to a given cognitive problem.

People tend to draw more heavily on metacognitive experiences if a cognitive task is uncertain or novel (i.e., when metacognitive awareness is heightened). For example, consider a student pilot faced with the novel task of learning to make sense of the control mechanisms of an airplane. It is possible that he or she will equate flying an airplane as analogous to driving a car, and therefore draw on past experiences, memories, intuitions about driving a car to facilitate cognitive sense-making relative to the act of flying an airplane.

Similarly, metacognitive experiences play a significant role in cognitive strategy formulation when the consequences of failure are great (Flavell, 1987). For example, consider an executive given the task of evaluating expansion into a new market. The risks of failure, given the required capital investment of such an expansion, are very high. Therefore, it is likely that he or she will consciously consider such a move in the context of past experiences, intuitions, and memories of similar experiences (Forster, Higgins, & Idson, 1998). Conversely, if the risks of failure are insignificant, cognitive processing will be more automatic, and the role that past experiences, intuitions, and memories play in formulating a cognitive response will be lessened (Shiffrin & Schneider, 1977).

Finally conflict, contention, competition, and rivalry also trigger metacognitive experiences in the form of emotion. Like experience, intuition, and memory, individual emotions color how people choose to perceive the appropriateness of a given cognitive response to a particular situation or cognitive problem. Building on the example of the executive considering the prospect of expanding into a new market, the more contentious and competitive the business

environment, the more likely it is that the executive's own emotions concerning that competitive rivalry will influence the metacognitive strategy he or she chooses to employ to make sense of the prospect of market expansion. Thus,

Proposition 4: *The greater the metacognitive knowledge, the more appropriate the cognitive response is to context and motivation.*

Proposition 5: *The greater the metacognitive experience, the more appropriate the cognitive response is to context and motivation.*

Metacognitive Control

When an individual with heightened metacognitive awareness draws upon his/her metacognitive resources, s/he will develop a metacognitive strategy for how to 'think about thinking.' While a cognitive strategy refers to an existing mental method (such as visualization) used to generate some outcome (such as a business's mission statement), metacognitive strategizing refers to the process through which one generates alternative ways for creating cognitive strategies. For example, an individual may typically rely upon a cognitive strategy based on the analysis of data and numbers to understand situations. When this person is faced with a highly ambiguous situation in which the data are unclear or unavailable, she may engage in metacognitive strategizing to change her original cognitive strategy (data analysis) to a new one (e.g. use of analogies). Metacognitive strategies focus on ensuring that some performance or cognitive goal has been met by controlling selection of a cognitive response from a set of available cognitive responses. This aspect of metacognitive processing is consistent with Fiske and Taylor's "motivated tactician" framework in that based on how an individual perceives a task or situation relative to his/her own motivations, he/she will select an appropriate cognitive response given

several cognitive options. This response, for example, may be to activate an existing schema/heuristic, etc, and this response is then responsible for some outcome – which may be either cognitive (i.e. comprehension) or behavioral (some action).

For example, consider an experienced entrepreneur faced with the challenge of deciding the most appropriate avenue through which to secure funding for her venture. The entrepreneur has knowledge, accessible at a metacognitive level, of various strategies for securing such funding (angels, friends & family, venture capital, etc), as well as past experiences funding similar ventures. The entrepreneur also has intuitions as to the most appropriate funding source given the nature of the particular venture. This knowledge is enacted through the development of a metacognitive strategy – a strategy for ‘thinking about thinking’ given the task at hand – focused on the most appropriate cognitive response so as to realize the goal of funding the venture.

In addition to cognitive responses, behavioral and emotional outcomes may result from the employment of metacognitive strategies. Such outcomes may include experiencing anger or frustration. Ultimately, these outcomes provide feedback for subsequent metacognition. For example, consider an entrepreneur faced with the dilemma of responding to a problem with a defective part, given that he needs to fill a key customer’s order in 2 days. In this example, context is defined by the time constraint of having to solve the problem with the defective part in 2 days. The entrepreneur’s motivation to solve the problem is based on the pressures imposed by the customer order. The entrepreneur jointly considers his motivation and the context (limited time), and decides his best course of action is to search out another

supplier of the part. The process of deciding his best course of action (to finding another supplier) given his context and motivation is his metacognitive strategy. This strategy was responsible for “controlling” the selection of a more proximate cognitive response – identifying alternative suppliers – given a variety of possible cognitive responses (i.e. identifying in-house talent suitable for fixing the defective parts, identifying the costs of delaying the customer order, etc.).

Our model does not predict which particular metacognitive strategy or cognitive strategy an individual will use, other than saying it will depend upon the context, motivations, and metacognitive resources of the individual. It is useful to consider, however, whether the use of a metacognitive strategy in general will help an individual achieve his or her goal. Staw and his colleagues demonstrate that employing a metacognitive strategy is likely to help an individual avoid using the wrong strategy to pursue the goal given his or her motivations and environmental context (Staw & Boettger, 1990; Staw et al., 1981).

Proposition 6: *The greater an individual's use of metacognitive strategies, the more appropriate the cognitive response is to context and motivation.*

Metacognitive Monitoring

Flavell writes that “while a cognitive strategy is simply one to get the individual to some cognitive goal or sub goal...the purpose [of a metacognitive strategy] is no longer to reach the goal (cognitive strategy), but rather to feel confident that the goal has been accomplished” (1987: 23). Consistent with this, my model includes mechanisms to assess the outcome of a given cognitive response relative to motives, metacognitive knowledge, and metacognitive experience (Flavell, 1979, 1987). Monitoring of an individual's own cognitions can/does occur both

during attention to a particular cognitive task (metacognitive monitoring), as well as in response to some cognitive or behavioral outcome (performance monitoring).

The individual will reflect on how, why, and when to use certain strategies (as opposed to others) to facilitate reasoning and behavior. For example, a metacognitive strategy might be responding to task demands by differentially allocating resources (Kahneman, 1973). An associated cognitive strategy might be to allocate limited cognitive attention to a task according to its relative novelty (Kahneman & Tversky, 1972). Cognitive strategies also influence metacognitive strategies. The implementation of a given cognitive strategy may sensitize an individual to cues from the context, reciprocally influencing metacognition (metacognitive monitoring).

For example, one aspect of metacognitive monitoring is recognition of task demands, such as the complexity of a perceived business opportunity. A serial entrepreneur with considerable expertise at identifying and evaluating business opportunities might quickly peruse possible ideas and return to certain ones for in-depth study and analysis instead of evaluating each idea carefully the first time. After glancing over different ideas, he might notice that one idea for a new business relates to a business idea that he had already successfully implemented. This results in his changing the specific evaluation strategy and delving into the specifics of this idea more carefully because he is already familiar with the material (monitoring).

Performance monitoring serves to inform how an individual perceives the interaction between his/her environment and motivations both *across* and *within* cognitive endeavors. Depending on the cognitive outcome, the performance

monitoring mechanism will cue the individual to re-assess his or her metacognitive knowledge and/or metacognitive experience. Depending on the relation of current performance and an individual's motives, the performance monitoring mechanism will cue the individual to re-evaluate his or her motivation (Locke, Fredrick, Lee & Bobko, 1984; Locke & Latham, 1990; Nelson, 1996; Nelson & Narens, 1994). I expect that the information provided by both monitoring mechanisms serves to evolve and define subsequent metacognitions, and lead to a change in the metacognitive strategy and thus, the cognitive response.

Proposition 7: *The greater the metacognitive and performance monitoring, the more appropriate the cognitive response is to context and motivation.*

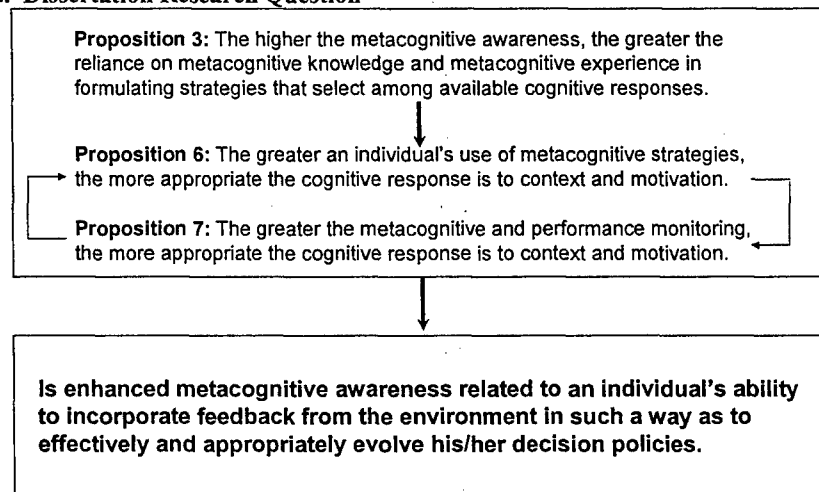
Cognitive Adaptability and Metacognition in Entrepreneurship

Entrepreneurial outcomes include the discovery and exploitation of opportunities to bring into existence future goods and services (Shane & Venkataraman, 2000), new entry through the introduction of new products in new or existing markets, or the introduction of existing products into new markets (Lumpkin & Dess, 1996), or new firm creation (Gartner, 1988; Sarasvathy, 2001). To study entrepreneurship, I define the context and motivations represented in Figure 1 to be entrepreneurial in character. In particular, my emphasis is on the *combination* of an uncertain entrepreneurial context and relatively non-specific entrepreneurial goals, as this combination related to the need for the entrepreneur to realize a state of cognitive adaptability consistent with an 'entrepreneurial mindset' (Ireland et al., 2003).

To investigate the entire spectrum of implications for further study proposed in this chapter, however, is beyond the scope of this dissertation. In the end I believe that a metacognitive perspective focused on the role that metacognition

plays in promoting cognitive adaptability in the face of an uncertain, dynamic environment, serves to expand and extend the potential of cognitively orientated research in entrepreneurship. Therefore my empirical focus considers two metacognitive constructs that theory indicates to be highly related to adaptability: 1) metacognitive awareness, and 2) metacognition monitoring. Therefore, in the next chapter I will develop specifically propositions 3, 6, and 7 into a series of testable hypotheses focused on the role that metacognition plays in promoting cognitive adaptability (Figure 2.2 below):

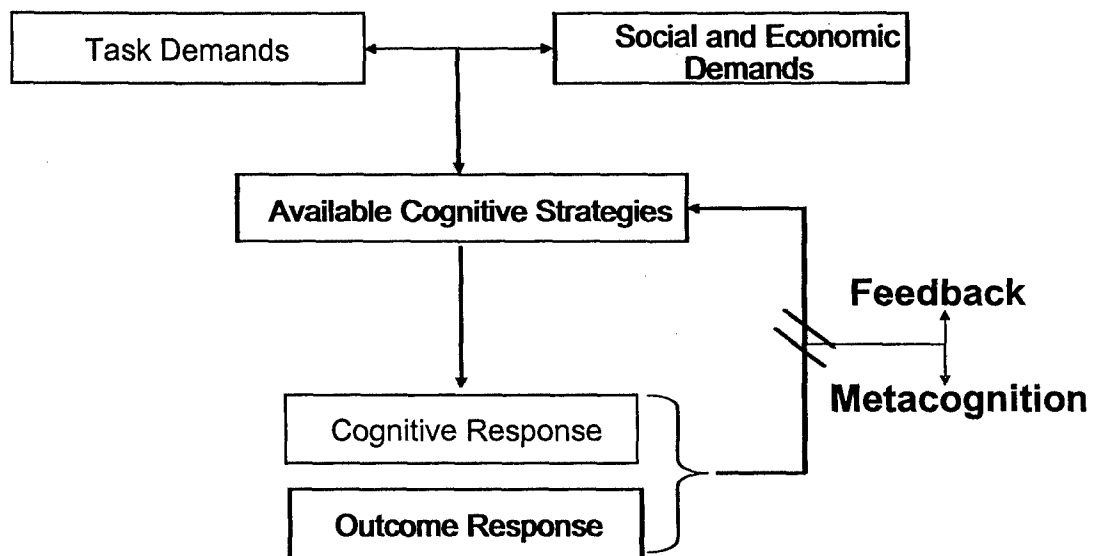
Figure 2.2. Dissertation Research Question



The model of situated metacognition developed here suggests that those individuals with high metacognitive awareness are more likely to engage in the process of employing metacognitive strategies (proposition 3). Further, those with high levels of metacognitive awareness are also more apt to monitor their own cognitions in light of some desired outcome or behavior. Conceptually, the reciprocal relationship between an individuals' use of metacognitive strategy (proposition 6) and the ability of an individual to 'monitor' and inform his/her own cognitions (proposition 7) is consistent with my conceptualization of cognitive adaptability.

Specifically, metacognitive *awareness* of strategy is an antecedent to metacognitive monitoring. Metacognitive monitoring, in turn, serves to further an individual's ability to incorporate feedback from the environment into the evolution of existing decision policies (or towards the development of new cognitive responses not already existing within an individual's response repertoire). This relationship is depicted below in figure 2.3.

Figure 2.3. Metacognition, Feedback, and Cognitive Adaptability



Therefore given that my interest in this dissertation concerns the entrepreneur's ability to cognitively adapt to a dynamic and uncertain environment, the ability to incorporate feedback from the environment (monitoring), and a subsequent activation of some level of awareness as to how that feedback should evolve decision strategies (awareness), is rightfully the focus of my empirical efforts.

In Chapter 3, I will develop a series of testable hypotheses - based on the conceptual model proposed in this chapter, and drawing on theory and empirical findings focused on the effects of feedback on learning and performance - which will

allow me to rigorously investigate the relationship between metacognitive awareness and cognitive adaptability.

CHAPTER THREE

THEORETICAL FOUNDATION AND RESEARCH HYPOTHESES

Introduction

In this chapter I present the foundation for the development of a set of research hypotheses focused on the overarching theoretical perspective described in Chapter II of this dissertation. Specifically I draw on metacognitive theory, which acknowledges the existence of a continuous reciprocal interaction between cognitive strategy selection and inputs to that process in the form of outcome and cognitive feedback from the environment. This perspective is supplemented by theory focused on the role that feedback plays in how people learn, specifically that the type and character of the feedback is directly related to an individual's ability to incorporate that feedback into future sense-making and decision policy.

As the summary to the previous chapter indicates, empirically my goal is to investigate the role that metacognitive monitoring plays in promoting cognitive adaptability while engaged in an entrepreneurial task. That said I first need to investigate an entrepreneurial task, and model the cognitive processes associated with that task. Once this is accomplished, in a subsequent study I can then model how metacognitive monitoring is related to cognitive adaptability in the context of performing that same entrepreneurial task. Therefore, this chapter proceeds as follows:

First I describe 'opportunity assessment' as an entrepreneurial task in the context of **Study 1** of this dissertation. I hypothesize that performance of that task

proceeds in a way consistent with the theoretical foundations of the Resource-Based View.

Second, in the context of **Study 3** I hypothesize relationships between cognitive adaptability and metacognitive monitoring in the context of the opportunity assessment task (developed in Study 1). Specifically I develop and present a series of hypotheses designed to investigate the relationship between adaptable performance on the assessment task and metacognitive monitoring. Consistent with learning feedback theories, I also focus on what types of feedback enhance the effectiveness of metacognitive monitoring in promoting cognitive adaptability and effective decision-making. Study 2 is a construct validation of metacognitive awareness with no specific, testable hypotheses and therefore not specifically addressed in this chapter.

An Entrepreneurial Task – Study 1

The process of discovering, evaluating, and exploiting opportunities is fundamental to the growth of existing firms, as well as the creation of new firms (Shane & Venkataraman, 2000). Fiet (2002) describes the goal of discovery as focused on realizing a valuable economic opportunity, and goes on to note that the “exploitation of an idea that is neither valuable nor rare can only lead to the generation of average profits” (2002: 2). This conceptualization of the discovery process - as realizing some valuable economic opportunity - suggests that entrepreneurs’ evaluations of the attractiveness of given opportunities precedes a decision to exploit, and involves a judgment as to the potential of these opportunities to generate and sustain above average profits for their firms. That said, I propose that

scholars have largely ignored the call by Shane and Venkataraman (2000) for research focused on the judgments associated with the *evaluation* of entrepreneurial opportunities.

Some have argued that the Resource-Based View (RBV) is well positioned as a theoretical lens to confer new insights into the concomitant processes associated with opportunity evaluation - opportunity discovery (e.g., Alvarez and Busenitz, 2001) and exploitation (e.g., Wiklund and Shepherd, 2003). According to the RBV, a firm's ability to generate and sustain above average profits is a function of the firm's endowment of resources. More specifically, the firm's ability to generate and sustain above average profits is a function of resource endowments that are valuable, rare, and inimitable/non-substitutable, and employed in such a way as to efficiently satisfy customer needs (Barney, 1986; Conner, 1991; Wernerfelt, 1984). From this perspective, strategy is a function of the managerial decisions as to how firms acquire these idiosyncratic - and thus heterogeneous - resources (Barney, 1991).

It is my position that while researchers acknowledge that the decisions as to 1) which resources to acquire, and 2) how to combine and employ those resources in production are difficult choices (Barney, 1991; Conner, 1991). However, empirical tests of the RBV generally ignore the critical, decision-making function of the manager in this process. Are all heterogeneous resources – those that are rare, valuable, and inimitable/non-substitutable - equally attractive to a manager or entrepreneur evaluating potential opportunities for the purpose of realizing a sustainable competitive advantage in the marketplace?

I address this question in an entrepreneurial context by focusing a resource-based lens, complemented by the literature on human capital, toward investigating 2,336 opportunity evaluation decisions (nested within a sample of 73 entrepreneurs). For the purposes of this study I define an entrepreneurial venture as an entity engaged in activities such as planning, networking, selling, and finding resources (e.g., Cooper, 1993; Duchesneau & Gartner, 1990; Van de Ven, Hudson & Schroeder, 1984; Vesper, 1990) focused on exploiting opportunities to realize value through the creation of future goods and services (Shane & Venkataraman, 2000). My aim is to determine whether the relationship between the attributes of an opportunity that promote and maintain its heterogeneity, and the opportunity's evaluated attractiveness, is moderated by the relatedness of the opportunity to the existing human capital of the entrepreneur.

In developing the theoretical basis for the hypothesized relationships presented in this study, I proceed as follows: First, I selectively review the literature on the RBV in the context of entrepreneurship, focusing on the entrepreneurial task of opportunity evaluation. Second, I incorporate existing literature focused on the role and function of specific human capital into my discussion of a framework for opportunity evaluation. Third, I propose a framework of entrepreneurial opportunity evaluation, and present a series of hypotheses focused on the character of opportunity evaluation given a resource-based framework.

A Resource-Based View

The core argument of the RBV is that firms differ based on their resource endowments, and the extent to which these heterogeneous endowments are employed

efficiently and effectively to satisfy customer needs can result in a sustained competitive in the marketplace (Barney, 1986, 1991; Dierickx & Cool, 1989; Rumelt, 1984, 1987; Wernerfelt, 1984). "The Resource-Based View is usually distinguished from other approaches to strategy by taking the individual resource as the unit of analysis when it comes to understanding the sources of SCA [sustained competitive advantage]" (Foss & Knudsen, 2003). Peteraf writes that one of the basic assumptions of "resource-based work is that the resource bundles and capabilities underlying production are heterogeneous across firms," and those with superior resource endowments are better able to satisfy customer needs and thereby realize Ricardian rents and monopoly profits (1993: 180).

Barney proposed that resources must meet a set of conditions in order to be considered heterogeneous in the context of providing a competitive advantage (1991; 105-106); specifically those resources must be: 1) *Valuable*- as defined by the potential of the resource to improve the efficiency and effectiveness of existing products or processes, 2) *Rare*- defined most simply as limited in supply among the firm's competition, 3) *Inimitable* - thus difficult for other firms to copy, and 4) *Non-substitutable* - or difficult for other firms to introduce substitute products to the market thus "making the demand curves of monopolists or oligopolists more elastic" (Peteraf, 1993). Based on the above definitions, non-substitutability is a specialized type of inimitability (Barney, 1996). Put simply, firms that control valuable and rare resources possess a competitive advantage, and further if these resources are inimitable and non-substitutable, that competitive advantage can be sustained (Barney, 1991; Foss & Knudsen, 2003).

In her influential 1993 article, Peteraf “more explicitly [than Barney 1991] draws on price-theory, takes individual resources as the relevant level of analysis, and reaches different conclusions [than Barney 1991] with respect to the conditions of SCA (sustained competitive advantage)” (Foss & Knudsen, 2003). Central to the RBV is the notion that “efficient firms can sustain [competitive advantage] only if their resources cannot be expanded freely or imitated by other firms” (Peteraf, 1993: 181). Peteraf proposed that heterogeneity can be maintained and therefore yield a sustained competitive advantage based on a set of additional considerations of limits to competition, over and above those of inimitability and non-substitutability (1993).

The first condition is when *ex post limits* on competition are high. Prior to the firm employing its resources directed at gaining a superior position and earning rents, there must be forces in the market which serve to limit competition for those rents to ensure that the “rent differential is not eliminated through product market competition” (Foss & Knudsen, 2003). Second, resource heterogeneity can be maintained when factors are not perfectly mobile, that is, cannot be traded freely or acquired easily on the open market. Third, resource heterogeneity can be maintained when there are *ex ante limits* on competition. Prior to the firm employing its resources directed at gaining a superior position and earning rents, there must be forces in the market which serve to limit competition for that position. Therefore, *ex post limits* on competition prevent the profits arising from a competitive advantage from being competed away, imperfect factor mobility ensures that valuable resources (factors of production) remain within the firm and, *ex ante limits* on competition ensure that the costs of establishing those resources as productive in a given market

position do not off-set the rents the firm generates from those resources. The core argument here – which serves to distinguish Peteraf's position from that of Barney – is that Peteraf proposes that the firm requires not only inimitable resources, but also the ability to limit competition as those resources are employed to generate Ricardian rents (1993).²

By integrating these two perspectives toward a cohesive framework, competitive strategy becomes a function of the managerial decisions as to how firms both *acquire* heterogeneous resources, and *employ* these idiosyncratic resources in such a way as to limit competition in order to achieve a sustainable advantage over competitors (Barney, 1991; Peteraf, 1993). At the gestation of a new venture or throughout the growth stages of an existing firm, it is my position that the assessment of the likely performance of an entrepreneurial firm requires concomitant consideration of the resources of entrepreneurs in terms of their knowledge, skills and abilities, and the nature of the opportunity itself. I first discuss entrepreneurs' human capital in terms of existing knowledge, skills and abilities, and then turn my attention to the nature of opportunities and the role that entrepreneurs' knowledge, skills and abilities plays in moderating opportunity evaluation decisions.

² Some may argue that a resource that cannot be easily imitated, by definition, serves to limit competition for the future market position that the resource may occupy. This raises the question can a resource be highly inimitable but yet be employed in a market position where limits on competition for rents are low? The answer to this question serves to distinguish Ricardian from Paretian rents and is beyond the scope of this paper. However, acknowledging the we are aware of the distinction is relevant so far as to make clear that in the empirical investigation into opportunity evaluation that follows, we do not assume that an opportunity will be exploited in its 'first-best' use and thus acknowledge that a highly inimitable resource may be employed in a market position where limits to competition for the resulting rents can be low. (see Peteraf, 1993).

Entrepreneurs' Resource Endowments

Recently, a number of entrepreneurship scholars have focused their attention toward investigating how the idiosyncratic characteristics of the entrepreneur – in terms of attributes such as prior knowledge, related experiences, and skills - may impact performance in the context of an entrepreneurial environment and on entrepreneurial tasks. Findings indicate that these human capital variables significantly influence the performance on entrepreneurial tasks, and offer insight into a myriad of entrepreneurial outcomes. For example, Ravasi and Turati found that prior, related knowledge was predictive of entrepreneurs' allocation of time, attention, and resources given competing entrepreneurial tasks (2005). In a study of nascent entrepreneurs, Davidsson and Honig found that human capital characteristics were related to entry into nascent entrepreneurship (2003). Finally, Gimeno and his co-authors demonstrated that organizational survival is not strictly a function of economic performance, but is also determined by the entrepreneur's human capital characteristics (Gimeno, Folta, Cooper, & Woo, 1997).

Human capital theory proposes that individuals with more and/or higher quality human capital achieve higher performance in executing relevant tasks (Becker, 1964; Gibbons & Waldman, 2004). The human capital of entrepreneurs has been captured in terms of knowledge and skills (Cooper, Folta, & Woo, 1995; Davidsson & Honig, 2003; Wright et al., 1997) as well as abilities (Alvarez & Busenitz, 2001; Gifford, 1993). Although there have been some findings in support of the notion that the more of these general resources an entrepreneur possesses the more likely he or she will be to discover opportunities (e.g., more knowledge

provides an individual with a greater opportunity set [Gimeno, Folta, Cooper and Woo, 1997] and the ability to profitably exploit them [Wright et al., 1997]), the human capital literature highlights the importance of specific human capital - knowledge, skills and abilities that are useful to a specific task but have few applications outside of this domain (cf. Becker, 1964; Gimeno *et al.*, 1997).

Building on Becker's (1964) seminal work on human capital theory, Gibbons and Waldman (2004) recently introduced to the economics literature a type of human capital they term 'task-specific.' They differentiate task-specific human capital - from both general and firm-specific human capital - as being specific to a particular task or set of related tasks, and it is accumulated on the job from task-specific learning-by-doing. Productivity is maximized when individuals engage in tasks which best utilize this accumulated human capital, i.e., tasks that are highly related to those tasks from which the human capital was developed (Becker, 1964; Gibbons & Waldman, 2004).

Consistent with Waldman and Gibbon's theory and the human capital literature in general, I propose that entrepreneurs assess their chances of achieving a competitive advantage from an opportunity as higher when they have human capital specific to that opportunity, that is, the knowledge, skills and abilities that are highly related to the opportunity. Entrepreneurial opportunities are simply defined here as a set of circumstances favorable for the "creation of future goods and services to come into existence" (Shane & Venkataraman, 2000) that can be combined with the existing resource endowments of the entrepreneur for the purposes of realizing a competitive advantage. Opportunities, once exploited, result in the building of

efficient business systems for full scale operations committed to gain returns from the new product arising from the opportunity (March, 1991). Thus,

H1: The more related an opportunity to the entrepreneur's existing knowledge, skills, and abilities, the more positively an entrepreneur is likely to evaluate that alternative.

Opportunities, Task-Specific Human Capital, and Opportunity Evaluation

Given the notion of task-specific human capital, I suggest that resources resulting from exploitation that are highly related to the exiting human capital of the entrepreneur confer upon the entrepreneur a marginally *superior* set of strategic choices in terms of how, where, and through what means exploitation can proceed. The uncertainty that characterizes entrepreneurial environments is central to this argument (Knight, 1921). Generally, in order for the entrepreneur to realize and sustain above average returns resulting from exploitation, the venture must position itself in the marketplace in such a way as to remain flexible in the face of a dynamic and uncertain environment. For a new, emerging firm this is possible only if "they can access a full range of complementary assets" required to fully exploit the opportunity and sustain above average returns (Hamilton, Vila, & Dibner, 2001). Thus I propose simply that entrepreneurs are attracted to opportunities that result in resources or resource bundles complementary – or related – to their existing human capital assets *because* they perceive more and higher quality strategic choices relevant to avenues of exploitation.

I equate this with what Gleick (1987) termed the "Butterfly Effect," specifically that small differences in the quality of the input quickly become large differences in the quality and quantity of output. In the case of opportunity evaluation, the

entrepreneur is looking for a marginal 'edge' on the input side of that equation that would confer a substantial return once the opportunity is successfully exploited. I propose that entrepreneurs perceive that marginal edge as resident in their own knowledge, skills, and abilities – or human capital. Below I hypothesize a set of relationships suggested by the integration of RBV and human capital theories in the context of entrepreneurial opportunity evaluation.

For the purposes of this study I define opportunity *value* – consistent with the RBV – as the potential of the resources resulting from exploitation to increase efficiency and effectiveness of existing products or processes. All else equal, proponents of the RBV would assert that the more valuable the opportunity (and the resources that result), the more attractive that opportunity should be to the entrepreneur because exploiting the opportunity will further the efficiency and effectiveness of the entrepreneurs existing products and/or services (Duliba, Kuaffman & Lucas, 2001). Further, by integrating human capital theory I propose that entrepreneurs' are likely to assess their ability to make the most of a valuable opportunity as greater when that opportunity is highly related to their existing knowledge, skills and abilities (as opposed to when it is less related). Put simply, a related opportunity – in the context of value – is one where the potential of the opportunity to increase efficiency and effectiveness is greatest. Eisenhardt and Schoonhoven (1990) noted that new ventures, because of limited resources, are "particularly vulnerable to even slight inefficiencies" thus serving to "limit their ability to shift to more favorable circumstances" (Eisenhardt & Schoonhoven, 1990; Van de Ven, Hudson, and Schroeder, 1984). An opportunity where the resources that result from exploitation

are complementary and related to the human capital resources of the entrepreneur confers a situation where the effects of a valuable resource 'cut both ways.' In this case the opportunity resource serves to enhance the human capital resources of the entrepreneur (making them more efficient and effective), and the related human capital resources of the entrepreneur further enhance the value of the opportunity.

Thus,

H2: The more valuable an opportunity, the more positively an entrepreneur is likely to evaluate that alternative although this relationship is more positive when the opportunity's relatedness to the entrepreneur's existing knowledge, skills, and abilities is high than when it is low.

I define opportunity *rarity* – consistent with the RBV – as the extent to which information about the opportunity is limited (available to others). Again, all else equal, proponents of the RBV would assert that the more rare the opportunity (and the resources that result), the more attractive that opportunity should be to the entrepreneur. Integrating human capital theory, I propose that the entrepreneur will be best positioned to take advantage of high rarity when the opportunity is also highly related to the entrepreneur's existing knowledge, skills and abilities. This may be the case because his/her prior, related human capital will allow him/her to select and secure the most important distribution channels (Karakaya and Kobu, 1994), position the firm in the center of a new market (Lane, 1980), have their product adopted as the industry standard (Carpenter and Nakamoto, 1989), and grasp subsequent opportunities; in short, capitalize on being first to exploit an opportunity (Lieberman and Montgomery, 1998; Robinson and Fornell, 1985). Thus,

H3: The more rare an opportunity, the more positively an entrepreneur is likely to evaluate that alternative although this relationship is more positive when the

opportunity's relatedness to the entrepreneur's existing knowledge, skills, and abilities is high than when it is low.

For the purposes of this study I define opportunity *inimitability*– consistent with the RBV – as the extent to which others can imitate (or develop substitutes for) the opportunity and the resources that result. Thus all else equal, based on the RBV, the assessed attractiveness of a given opportunity (and the resources that result) should be greater in situations where it is difficult for competitors to develop substitutes or imitate the resources that result from exploiting the opportunity. Like the previous hypotheses, I propose when this relationship is considered in the context of the entrepreneur's human capital, the positive relationship between inimitability and the attractiveness of the opportunity is further enhanced. This proposition is generally consistent with the findings of McEvily and Chakravathy (2002), who investigated the performance relationships between inimitability and knowledge and found that attributes of human capital, such as knowledge, prolong the large, performance advantages that can result from the tacitness and specificity of a given resource.

Thus,

H4: *The less imitable an opportunity, the more positively an entrepreneur is likely to evaluate that alternative, and this relationship is more positive when the opportunity's relatedness to the entrepreneur's existing knowledge, skills, and abilities is high than when it is low.*

I define opportunity *Limits on Competition* – consistent with the RBV – as the extent to which the future market position for the opportunity is defensible or not, so that all else equal, the RBV would suggest that the more defensible the market position for the opportunity resources that result from exploitation, the more attractive the opportunity to the entrepreneur. Further, integrating human capital theory, I propose that entrepreneurs are likely to assess their ability to make the most of a

highly defensible market position when that opportunity is also highly related to their existing knowledge, skills and abilities (as opposed to when it is less related). For example, entry barriers allow pioneers to operate in their industry for a grace period under conditions of limited competitive rivalry (with the possible exception of substitute products) (Shepherd and Shanley, 1998); entrepreneurs with knowledge, skills, and abilities related to this opportunity are best positioned to use this period of limited competition to place limits on competition – and prepare for the eventual entry of new competitors by building barriers to entry (see Carpenter and Nakamoto, 1989; Robinson and Fornell, 1985; Schmalensee, 1982) and shape the direction of industry evolution (Ghemawat, 1991). Thus,

H5: *The higher limits on competition for the future market position for an opportunity, the more positively an entrepreneur is likely to evaluate that alternative, and this relationship is more positive when the opportunity's relatedness to the entrepreneur's existing knowledge, skills, and abilities is high than when it is low.*

Metacognition, Feedback, and Cognitive Adaptability – Study 3

A consistent theme throughout this dissertation has been the importance, in the context of an entrepreneurial environment, of cognitive adaptability – the ability to effectively and appropriately evolve decision policies (i.e. to learn) given feedback and inputs from the environmental context in which cognitive processing is embedded. I have hypothesized a series of decision criteria employed by entrepreneurs in the performance of an entrepreneurial task, however I have also theoretically established that the ability to change those decision policies (the way in which they use the decision criteria) may be important as the context (environment) in which those decision criteria are employed evolves. The important question then

becomes, 'how and why are individual's different in their ability to adapt decision policies in response to an evolving, changing environmental context?' In Chapter II, I proposed an answer to this question – specifically that two types of cognitive monitoring (metacognitive & performance monitoring, employed through heightened metacognitive awareness) enable the individual to effectively and appropriately incorporate feedback from the environment into their decision policies, and therefore promote cognitive adaptability in the face of a changing environment. However, while metacognition – and specifically the ability to monitor the selection, execution, evolution of a given cognitive strategy – is at the core of realizing cognitive adaptability, literature focused on the role of *feedback* indicates that the ability to effectively and appropriately incorporate inputs from the environment depends on the nature and character of the input itself. Put simply, the *type* of feedback matters.

Therefore, I propose that heterogeneity in cognitive adaptability may be investigated based on what I will characterize as *internal* and *external* components. Internal to the individual, heterogeneity in cognitive adaptability results from, in part, individual differences in metacognitive awareness. Above and beyond individual differences in metacognitive awareness, heterogeneity in cognitive adaptability is also a function of the type and character of feedback the individual receives from the environment. This component is *external* to the individual.

Heterogeneity Internal to the Individual - Monitoring

Generally, cognitive monitoring is the process through which feedback from the environment is incorporated into a metacognitive strategy focused on selecting an appropriate cognitive response to a given task or situation. Flavell writes that “while

a cognitive strategy is simply one to get the individual to some cognitive goal or sub goal...the purpose [of a metacognitive strategy] is no longer to reach the goal (cognitive strategy), but rather to feel confident that the goal has been accomplished" (1987: 23). Monitoring of an individual's own cognitions can/does occur both during attention to a particular cognitive task (metacognitive monitoring), as well as in response to some cognitive or behavioral outcome (performance monitoring).

Metacognitive monitoring processes operate during attention to a particular task or situation, and are akin to an awareness of one's learning relative to some desired outcome. For example, consider a student reading a text with the goal of comprehension. Self-questioning is a common mechanism to promote a cognitive assessment of an individual's learning and therefore progress towards achieving the goal of comprehension. If progress toward that goal is inadequate, a metacognitively aware individual will re-evaluate his/her cognitive approach to the task (i.e. skimming the chapter vs. in-depth reading) and adjust their cognitive strategy accordingly – in a way consistent with realizing the goal of comprehension. Metacognitive monitoring serves to inform the iterative development of subsequent metacognitive strategies *within* a particular task/situation.

Performance monitoring processes operate in response to some cognitive or behavioral outcome in light of individual goals. Given some outcome, performance monitoring sensitizes the individual to any discontinuity that exists between the current state and the goal state and compels the individual to either re-evaluate his entrepreneurial goals and/or the cognitive strategy employed to realize those goals.

In the end, the entrepreneurs' ability to monitor cognitive learning and detect inconsistencies between the desired state and the current state is fundamental to achieving a state of cognitive adaptability and promoting effective decision-making in the context of entrepreneurial endeavors. The ability to employ monitoring strategies, at a metacognitive level, is a process *internal* to the individual, and dependent upon an individual's level of metacognitive awareness. Thus,

H6: *Individuals with greater metacognitive awareness have greater cognitive adaptability at entrepreneurial tasks than those with less metacognitive awareness.*

Heterogeneity External to the Individual – Monitoring and Feedback

Feedback, in the context of learning theories, is most often characterized as either outcome based feedback, or cognitive feedback.

Outcome feedback refers to the process of providing the individual performance orientated information relative to some objective standard (Brehmer, 1987, 1990; Stermen, 1989a, 1989b). For example, indicating that a student scored a 6 out of a possible 10 points on a quiz. Outcome based feedback does not provide any contextual cues to the receiver as to the relationship between performance, the task, and subsequent learning. In contrast, cognitive feedback "refers to the process of presenting the person information about the relations in the environment (task information) ... relations perceived by the person (cognitive information)...and relations between the environment and the person's perceptions of the environment (functional validity information)" (Blazer, Doherty, and O'Conner, 1989).

Across repeated studies, findings consistently demonstrate that outcome based feedback is not related to improvements in performance on judgment and decision-

making tasks (Brehmer, 1980; Einhorn & Hogarth, 1978). Cognitive feedback, however, has been demonstrated to significantly improve performance on judgment tasks (Remus, O'Conner, and Griggs 1996). Blazer et al. found that cognitive feedback characterized by information about the relations between the task and the environment was highly related to an individual's ability to improve performance on subsequent, related tasks (1989).

Therefore, when considering the role of metacognitive monitoring in promoting cognitive adaptability, I propose that to effectively and appropriately incorporate feedback focused on informing decision policies is influenced by the type of feedback generated from a given situation or task. As such, in the context of this dissertation:

H7: *Individuals given cognitive feedback on their decisions at an entrepreneurial task have greater cognitive adaptability than those given outcome-based feedback.*

Metacognitive Awareness and Feedback – A Contingent Relationship

Finally, given the complementary nature of the relationship between the *internal* and *external* antecedents of cognitive adaptability – metacognitive awareness (internal) and the character of feedback (external) – it becomes important to investigate the interaction between these internal and external components as they relate to promoting cognitive adaptability in the performance of an entrepreneurial task.

As detailed in the previous section, the positive implications of cognitive feedback for improvements in performance and effective decision-making have been

found across numerous studies, performed in disparate decision-contexts (Remus, O'Conner, and Griggs 1996; Brehmer, 1980; Einhorn & Hogarth, 1978). However, these studies did not address specifically if everyone who receives cognitive feedback benefits equally. Are some individuals more adept at utilizing cognitive feedback – integrating the relationships between the task, the feedback, and their own decision policies – in a way to promote cognitive adaptability and thus normatively 'better' decisions? The answer to this question is almost certainly 'yes.' I suggest here that *one* of the origins of this individual difference – the extent to which cognitive feedback confers an improvement in decision performance – is due to heterogeneity in metacognitive awareness. After receiving cognitive feedback, I propose that metacognitively 'aware' individuals are more apt to recognize some discontinuity, highlighted by cognitive feedback, between their own cognitions, the attributes of a given task, and the desired outcome and evolve their decision policies accordingly.

The proposition developed above also highlights a similar question about outcome-based feedback. While cognitive feedback has consistently been found to improve decision effectiveness and promote learning, outcome-based feedback has demonstrated only marginal utility in promoting learning and improvements in decision performance; the most consistent finding being that outcome feedback functions to re-define the decision-makers goals and/or performance expectations (Harvey & Fischer, 2005; Slattery & Ganster, 2002). However as may be the case for cognitive feedback, the concomitant consideration of metacognition and outcome feedback prompts the question: are some individuals more adept at utilizing outcome feedback in such a way as to promote cognitive adaptability and thus normatively

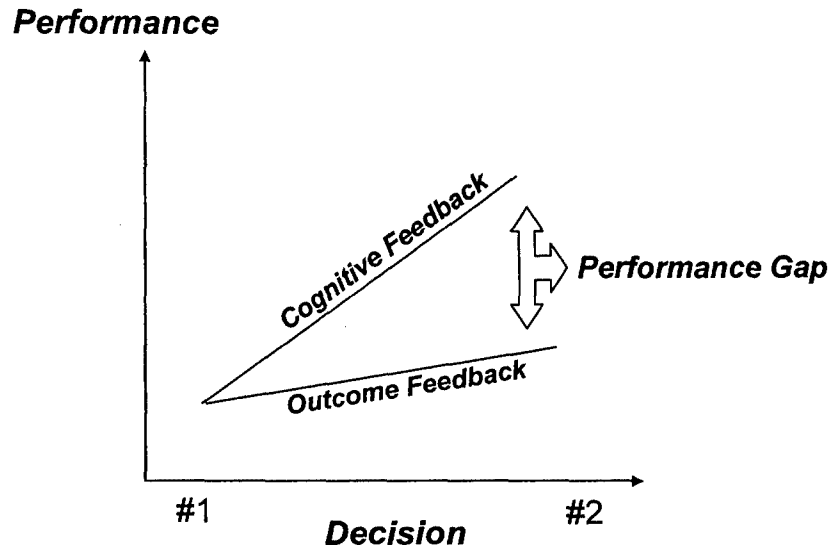
'better' decisions? Again, I propose that the answer to the question is likely 'yes,' but possibly in a manner (or magnitude) different from cognitive feedback.

Typically, outcome-based feedback provides the decision-maker with inferior or inadequate information (as opposed to cognitive feedback) concerning the relationship between his/her own decision and some performance outcome (Hammond, Summers, & Deane, 1973; Castellan, 1974). As a result, the decision-maker's ability to make normatively meaningful changes in subsequent decision policies is limited - that is to say that while outcome feedback can certainly motivate a change in decision policy, the normative implications of that change are dubious given the nature of outcome feedback (e.g. In an experimental study, Castellan (1974) found that outcome feedback framed as a 'percentage correct' score - as in this study - actually had a detrimental effect on subsequent decision performance). That said, it could be that individuals who are highly metacognitively aware draw on metacognitive resources (metacognitive knowledge and experiences) to make relational inferences given the outcome feedback. In essence, they transform outcome feedback into cognitive-type feedback by inferring relationships based on intuitions and experiences thus promoting marginal, normative improvements in subsequent decision policies. But of course the scope to do so, and for those more metacognitively aware to benefit from the feedback, is greater when that feedback is cognitive rather than outcome in nature.

To summarize the findings detailed above, the role of both cognitive and outcome-feedback, as related to learning and decision-making, has been the subject of rigorous and thoughtful research for decades. Generally this research highlights that

both outcome and cognitive feedback confer some benefit to the decision-maker in terms of normative improvements in decision performance given an iterative decision process, and that the magnitude – or scope - of that benefit is greater for cognitive feedback than for outcome feedback as depicted at figure 3.1 below:

Figure 3.1. Cognitive vs. Outcome Feedback – The Performance Gap

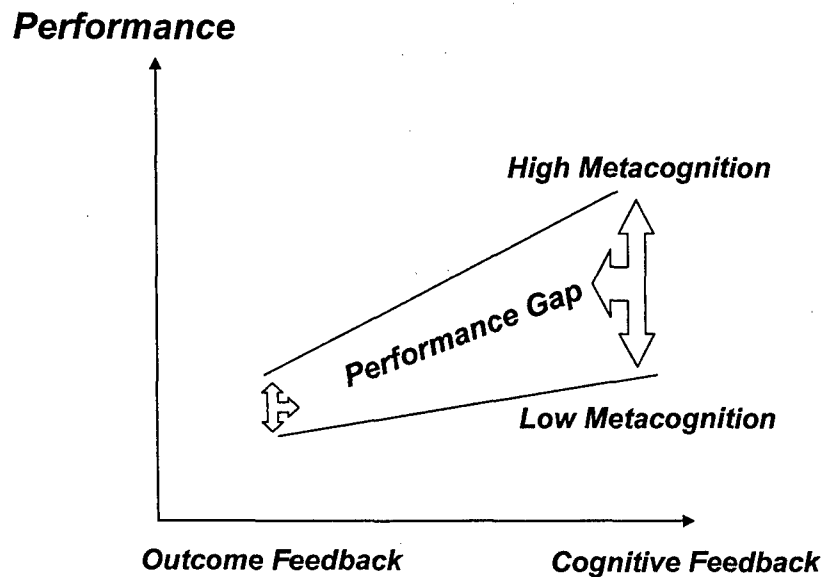


Performance is represented on the Y-axis, and represents the effectiveness of a given decision relative to realizing some goal or outcome. An iterative decision process is represented on the X-axis, such that moving from left to right represents progressing from decision #1 to decision #2. The relationship between both outcome and cognitive feedback and performance is plotted as depicted by the positive change in slope in the case of both outcome and cognitive feedback. As depicted above, while both cognitive and outcome feedback generate improvements in performance moving from decision #1 to decision #2, improvement is more positive for individuals receiving cognitive feedback than for those receiving outcome feedback, thus resulting in the 'performance gap' described above. Consistent with the

literature, the performance gap between outcome and cognitive feedback is reflective of the benefits of the additional information (over outcome feedback) conveyed to the decision maker by cognitive feedback.

That said, I suggest here that the utility of both outcome and cognitive feedback is higher (or 'more' positive) for individuals who are aware of and engage metacognitive strategies. Put simply, improvements in decision performance - given either outcome or cognitive feedback - are more significant for individuals who are highly metacognitively aware as opposed to those less metacognitive aware. This proposition is represented at Figure 3.2 below:

Figure 3.2. The Contingent Relationship between Feedback and Metacognition



In Figure 3.2 above, performance is plotted on the Y-axis, and represents the effectiveness of a given decision relative to realizing some goal or outcome. Feedback type is plotted on the X-axis, such that moving from left to right represents a change in feedback type from outcome-based to cognitive feedback. The relationship between metacognitive awareness (high and low) and performance, in

both feedback conditions, is plotted. Figure 3.2 depicts my suggestion that the benefits of cognitive feedback over outcome feedback are greater for individuals high on metacognitive awareness as compared to those individuals low on metacognitive awareness – as captured above by the significantly more ‘positive’ slope of the line depicting the relationship between high metacognition and performance when moving from outcome to cognitive feedback conditions. This has the effect of increasing the performance gap described above such that the magnitude – or scope - of the performance gap becomes greater as metacognitive awareness increases. Thus,

H8: *The positive relationship between cognitive (over outcome) feedback and cognitive adaptability is more positive for those individuals with higher metacognitive awareness than those with less metacognitive awareness.*

In summary, I have suggested that both cognitive and outcome based feedback confer some benefit to the decision-maker given an iterative, decision process. Because cognitive feedback relates the characteristics of an individual’s decision to the characteristics of some normative outcome, cognitive feedback is more apt to promote adaptable decision-making given a dynamic context. Finally, I have proposed that the benefits of both cognitive and outcome-based feedback as related to cognitive adaptability are more useful to individuals who are highly metacognitively aware but that the scope to benefit from high metacognition is greater for cognitive feedback than outcome feedback.

In the subsequent chapter I describe the methodology employed to test the hypotheses detailed in this chapter, as well as those methods utilized to construct the measure of metacognitive awareness (Study 2).

CHAPTER FOUR

RESEARCH METHODS

Considerable opportunity exists for scholars to employ frameworks focused on cognitive adaptability to investigate both individual and organizational performance across a wide variety of tasks, situations and environments. The fact remains, however, that progress toward that end has been impeded by several factors, including a lack of 'generalizable' scales to assess metacognitive awareness, and a notable lack of applied research such that the role of metacognition can be investigated in the context of some normative task (Schraw & Dennison, 1994). Thus it is the empirical aim of this research to develop both a reliable measure of metacognitive awareness, and to subsequently employ that measure toward investigating the role of metacognition in promoting cognitive adaptability in individual's engaged in an entrepreneurial task.

As described at the conclusion of Chapter 1, the empirical contribution of this dissertation is defined by three, individual studies linked in a means-ends relationship. In *Study # 1*, I model and decompose the 'opportunity assessment' decision policies of a sample of entrepreneurs. In *Study # 2*, I develop and validate a measure of metacognitive awareness. In *Study # 3*, I model and decompose the "opportunity assessment" decision policies of a sample of individuals that are inexperienced at this entrepreneurial task, investigating the effects of metacognitive awareness and cognitive feedback (and their interaction) in promoting cognitive adaptability in the context of an entrepreneurial task.

In Chapter 1 of this dissertation I described how these studies link together so as to allow me to investigate cognitive adaptability in an entrepreneurial environment.

In this chapter I consider each study separately, detailing the specifics of the three studies in terms of samples, variables, and procedures employed to test relevant hypotheses. Further, specifically for Study #2 – the validation of the instrument designed to capture metacognitive awareness – I will report the full results in this Chapter as opposed to Chapter 5, where I report the findings of Study #1 and Study #3. The construct validation, while a meaningful contribution, is primarily a means to operationalize metacognition for Study 3. Therefore I choose to conclude discussion of Study #2 in this Chapter so as to promote a logical discussion of the core premise of the dissertation – cognitive adaptability – in Chapter 5.

Study 1: An Entrepreneurial Task

Overview

The process of discovering, evaluating, and exploiting opportunities is fundamental to the growth of existing firms, as well as the creation of new firms (Shane & Venkataraman, 2000). Logically, evaluation represents the concomitant link between discovery and exploitation. For example, Fiet (2002) describes the goal of discovery as focused on realizing a valuable economic opportunity, and goes on to note that the “exploitation of an idea that is neither valuable nor rare can only lead to the generation of average profits” (2002: 2). This conceptualization of the discovery process - as realizing some valuable economic opportunity - suggests that the entrepreneur’s evaluation of the attractiveness of a given opportunity precedes a decision to exploit, and involves a judgment as to the potential of the opportunity to generate and sustain above average profits.

I propose that entrepreneurial opportunity assessment proceeds in a manner consistent with a conceptualization of opportunities as future resource options, complementary to existing resource endowments. The focus of this study is to investigate how resource characteristics are used by entrepreneurs when assessing the attractiveness of opportunities. In what follows I begin by discussing conjoint analysis as the technique employed to decompose the opportunity assessment policies of the entrepreneurs. In this section I discuss conjoint analysis, its appropriate use in this study, the experimental design, pilot testing of the conjoint study, and steps taken to improve validity. I will then move to discuss the sample, the procedures used to collect data, and the operational definitions of the variables. I will conclude the discussion of this study with an overview of the potential limitations of this study, and of conjoint analysis in general.

Conjoint Analysis.

In this study, conjoint analysis was employed to determine entrepreneurs' decision policies in the context of performing an opportunity evaluation task. Conjoint analysis is a technique that "requires respondents to make a series of judgments, assessments or preference choices, based on profiles from which their 'captured' decision processes can be decomposed into its underlying structure" (Shepherd & Zacharakis, 1997: 207). According to Green, Krieger and Wind (2001: 56), "thousands of applications of conjoint analysis have been carried out over the past three decades". Conjoint analysis was developed from the empirical research focused on how people actually make decisions (Green, 1984) and "is based upon rigorous research of information processing in judgment and decision making"

(Broonn & Olson, 1999). Conjoint studies have been used to study the individual strategic decision making of CEOs of manufacturing companies (Priem, 1994), and to quantify the importance of factors in managers' go/no-go decisions in hypothetical corporate ventures (DeSarbo, MacMillan & Day, 1987). In addition, conjoint analysis allows for the investigation of contingency relationships (two-way interactions) (Hitt & Barr, 1989) among the research variables. Because I hypothesize that entrepreneurs will use a contingent decision policy, conjoint analysis is a highly appropriate method to investigate the evaluation policies of the sample without relying on the respondents' introspection, which has been found to be often biased and inaccurate (Fischhoff, 1982; Priem & Harrison, 1994).

Experimental Design

In designing the experiment I utilized an orthogonal fractional factorial design from Hahn and Shapiro (1966). In an orthogonal design, inter-correlations between the variables are zero (orthogonal), which means that multicollinearity is not an issue and "increases the robustness of the conjoint by making it less likely that coefficients have counter-intuitive signs" (Huber, 1987). Because I am interested in a set of 5 evaluation criteria, a full factorial design would require 32 profiles. To reduce the decision task to a more manageable level, I used a fractional factorial design that reduced the number of original profiles (to 16). In choosing the fractional factorial design, I followed the general rule of confounding effects of most interest with effects that are unlikely to be significant or, if they are significant, are unlikely to cause much bias in the parameters that are estimated (Green & Srinivasan, 1990; Louviere, 1988).

Figure 4.1. Sample Opportunity Profile – Study 1

This opportunity is characterized as follows:

Assessment:

(Circle the number that best represents your response)

85

provide the error term necessary to conduct analysis at the individual level. Pearson R correlations can then be computed between each participant's evaluation of both the original and the 16 replicated profiles to assess the degree of judgmental consistency so as to test that the conjoint task was performed consistently by the entrepreneurs.

A common context for the experiment

In conjoint analysis, it is important to provide a common context from which the judgment is to be made to control subject variation (Shepherd and Zacharakis, 1997). This common context allows the subjects to relate the experimental decisions to those decisions and decision-contexts which are encountered throughout the course of everyday life. The instrument, and the accompanying instructions to the entrepreneurs, was designed so as to mitigate, and thus control for, unobservable effects on the entrepreneurs evaluations. The respondents were instructed that the purpose of this research is to better understand the decision process of entrepreneurs when assessing the potential of a given opportunity or set of opportunities. Each entrepreneur was told that they will be asked to evaluate a series of hypothetical opportunities, and that "opportunity" is defined as the potential to bring into existence future products and/or services, to be exploited in either existing markets or in new markets. The entrepreneurs were also told that when making these evaluations they were to assume the following: 1) that you are interested in exploiting new opportunities, 2) that you are assessing the opportunity in the context of your current business environment, 3) that the time horizon for exploitation of the opportunity is 2 years, 4) that there are no capital constraints (i.e. funding is available), 5) that

exploitation of the opportunity can occur either within your existing company, or through the formation of a new venture, 6) and that these opportunities will/could be exploited in the present US economic environment. Finally, the entrepreneurs were also instructed to consider each opportunity as a separate situation, independent of all others – and told not to refer back to scenarios already completed.

Finally, some researchers have reported strong attribute order effects for conjoint analysis (Johnson, 1989; Chrzan, 1994). To be conservative, I developed four different versions of the experiment so that I could investigate the impacts of 1) the order of individual profiles assigned and 2) that the order of the groups of variables (rarity, value, inimitability, limits on competition, and relatedness) did not have an impact on the results. To this end, four different versions of the study were developed. There were two different random assignments of the profile orders, and two random assignments of the attribute orders. Difference of means tests across the four versions demonstrated no significant differences ($p > .10$). This suggests that the order in which the variables were presented - and the order in which the profiles were presented - did not have a significant effect on the outcome of the experiment.

Pilot Testing

In order to assure face validity and increase internal validity in conjoint analysis, pilot testing should be completed prior to the data collection (Jarvenpaa, Dickson & DeSanctis, 1985). In this research, a pilot study was conducted with 10 Ph.D. students currently studying in the areas of management and marketing. Face validity was addressed by determining whether these individuals could recognize and apply the assessment attributes to the task of evaluation.

Changes made to the final version of the study as a result of this pilot test include: 1) re-wording the definition of the dependent variable to make it less 'academic,' and adjusting the operationalization of the variable "inimitable" to 'imitable,' for ease of understanding (reverse coding was employed as described below). As prescribed by Jarvenpaa, Dickson and DeSanctis (1985), debriefing the subjects of the pilot study is vital to understanding the subtleties associated with the task. Through debriefing the pilot sample I was able to understand practical implications of the presentation of the material, and thus make changes designed to facilitate a 'user friendly' instrument and thereby increasing internal validity.

Variables, Attributes, and Levels

Theoretical Justification for the Variables. In conjoint analysis, theoretical justification for the variables is essential because conjoint analysis requires judgment attributes to be known *a priori*. All variables used in this research have been developed from the integration of resource-based and human capital theories described in detail in Chapter 3.

Dependent Variable. The dependent variable in this study is entrepreneurs' evaluation of opportunity attractiveness conceptualized in a way consistent with empirical, resource-based work (Hatch & Dyer, 2004). The variable was operationalized as: *the potential that the given opportunity has, if exploited, to confer upon your company (or a new venture you create) a sustainable competitive advantage in the marketplace.*

To measure entrepreneurs' evaluations of attractiveness, I used an eleven point Likert-type scale anchored by the end points "not at all attractive" and "very attractive." The scale employed in the study was displayed to the entrepreneur as depicted in Figure 4.2 below:

Figure 4.2. Opportunity Attractiveness Scale – Study 1

How would you rate this opportunity's ATTRACTIVENESS?												
(Circle the number that best represents your response)												
Not at all Attractive	1	2	3	4	5	6	7	8	9	10	11	Very Attractive

Independent Variables. The decision criteria employed in this study are consistent with the theoretical integration of resource-based and human capital theories described in Chapter 3. Following contrast coding methodology suggested by Judd and McClelland (1989), for each attribute *high* was coded .5 and *low* as -.5 (with the exception of inimitability explained below). The attributes, and the levels at which each was operationalized in this study are as follows.

- **Value:** defined as the extent to which the opportunity exhibits the potential for considerable increases in efficiency and effectiveness. This variable was operationalized as: *High* – This opportunity exhibits the potential for considerable increases in efficiency and effectiveness. *Low* – This opportunity exhibits the potential for minimal increases in efficiency and effectiveness.
- **Rarity:** defined as the extent to which information about this opportunity is available to others. This variable was operationalized as: *High* – Information about this opportunity is not widely available to others. *Low* – Information about this opportunity is widely available to others.

- ***Inimitability***: defined as the extent to which the potential exists for others to imitate (or develop substitutes for) the opportunity. This variable was operationalized as: *High* – The potential for others to imitate (or develop substitutes for) the opportunity is considerable. *Low* – The potential for others to imitate or develop substitutes for the opportunity is minimal. For the purpose of analysis, this variable was reverse coded such that a more positive coefficient reflected greater emphasis on inimitability, i.e., high was coded as -.5 and low coded as .5.
- ***Limits on Competition***: defined as the extent to which the future market position for the opportunity is defensible. This variable was operationalized as: *High* – The market position for the opportunity is highly defensible. *Low* – The market position for the opportunity is difficult to defend.
- ***Relatedness***: defined as the extent to which the opportunity is related to the entrepreneur's existing knowledge, skills, and abilities. This variable was operationalized as: *High* – The opportunity is highly related to the entrepreneur's existing knowledge, skills, and abilities. *Low* – The opportunity is highly unrelated to the entrepreneur's existing knowledge, skills, and abilities.

Sample

Participants in this study included entrepreneurs identified through their association with a regional university entrepreneurship center. This center maintains a mailing list of entrepreneurs, venture capitalists, bankers, and entrepreneurship educators living and working within the region where the center is located. While the mailing list includes individuals other than entrepreneurs (venture capitalists, academics, etc), only individuals that identified themselves as an 'entrepreneur' when asked their primary occupation were included in the sampling frame.

Given the time pressures and often unpredictable schedule which characterize the life of an entrepreneur, I followed suggestions by Dillman (2000) focused on

encouraging high levels of participation in this research program. These procedures include: 1) multiple contacts, 2) high quality correspondence, 3) a degree of personalization, and 4) sponsorship and personal investment.

To encourage participation the entrepreneurs were initially mailed a personalized letter of introduction from the dean of the business school. This letter was individually addressed to each entrepreneur, and it explained the purpose of the research, introduced the researchers, and encouraged participation in the project as a way to support entrepreneurship education and research at the University (sponsorship). Within three days of that initial letter, the entrepreneurs received the survey booklet, and a cover letter from the researcher. This mailing also included a self-addressed, postage paid envelope for the entrepreneur to return the completed instrument to the University. Four days after receiving the survey package, each individual received an email simply asking them to confirm that they had received the survey. Those individuals that had not responded with 10 business days received a follow-up phone call.

Table 4.1 summarizes the mailing in terms of response characteristics. The final sample of 73 represents a sample size consistent with (and exceeding many) other conjoint studies (Priem & Rosenstein (2000) sample of 33; Shepherd's (1999) sample size of 63; Zacharakis' & Meyer's (1998) sample size of 50), and represents a relatively high response rate of 44%.

In addition, it is important to note that "conjoint analysis can achieve the same or superior statistical power with a considerably smaller sample size" as compared to traditional survey research (Shepherd & Zacharakis, 1997: 218). This is because

conjoint analysis provides multiple observations for each individual - facilitating individual level analysis - thus making it possible to realize a superior statistical power with a considerably smaller sample as compared to other statistical methods traditionally applied in management research. Researchers suggest that sample sizes greater than 50 are normally sufficient (Shepherd & Zacharakis, 1997), thus my sample of 73 entrepreneurs should confer adequate statistical power to detect even small effects.

Table 4.1. Sample Response Characteristics – Study 1

Sample as identified	197
Surveys mailed	197
Survey's returned as undeliverable	31
Final sample	166
Useable Responses	73
Response Rate	43.98%

The characteristics of the entrepreneurs and their firms are summarized in Table 4.2. Specifically 38% of the sample are women, the mean age range of the entrepreneurs in the sample is 35-44 years (standard deviation of 1.58), and the mean years of entrepreneurial experience is 14.2 (std. dev. 15.9). 72% of the entrepreneurs were founders of the firm they are currently associated with, and all remain involved in the management of their current firms. The mean age of the firms was 11 years (std. dev. 9.85), and 87% of those firms reported that they were actively seeking new opportunities to exploit at the time of they were contacted for this study. The post experiment questionnaire is included at Appendix A.

Table 4.2. Sample Response Demographics

<u>DEMOGRAPHIC</u>	<u>MEAN</u>	<u>STD. DEV.</u>
Age	35-44	1.58
Entrepreneurial Experience	14.2	15.9
Percentage Founder	72%	n/a
Age of Firm	11	9.85
Percentage Currently Engaged in Opportunity Search	87%	n/a

After completing the conjoint task, the entrepreneurs were asked to complete a comprehensive questionnaire. This questionnaire, in addition to collecting data on standard demographics such as age, gender, and education, focused on entrepreneurial experience, experience in evaluating opportunities, new venture experiences, and experiences in new product introductions. Entrepreneurs also self-reported the importance of the presented criteria in evaluating opportunity attractiveness on an 11-point scale with 1 being 'not very important' and 11 being "very important." On average all the criteria were somewhat important based on the following mean values reported for each of the evaluation criteria (standard deviations are in parentheses): Value: 7.7 (1.2), Rarity: 7.2 (1.8), Inimitability: 5.6 (1.04), Limits on Competition: 5.2 (2.1), and Relatedness: 8.2 (1.1).

Further, to test for differences between early and late respondents as to the importance of the evaluation criteria, the sample was stratified into two groups based on whether or not a response was received within 10 days of the survey mailing. Fifty-two of the seventy-three surveys returned were received within 10 days of the initial mailing. The early respondents ($n=53$) were compared to the late respondents ($n=20$) by investigating differences between their demonstrated decision policies; specifically, beta weights for each of the evaluation criteria were compared (between

the two groups) utilizing a two-sample t-test. This analysis was performed for each of the five evaluation criteria, and for the four hypothesized interactions. The analysis indicated no significant difference ($p < .05$) between the groups in any of the nine tests.

Potential Limitations – Study 1

My analysis has the potential to cast an interesting light on entrepreneurs' evaluations of opportunities, especially from a resource-based perspective. Still, this research shares some limitations with most judgment-based management research. Most of these involve challenges to the external validity of "paper-based" experiments; criticisms that artificial experiments do not have the immediacy, emotional importance, nor consider all the information used to make entrepreneurial decisions in "real life and the possibility that respondents could attach importance to attributes merely because they were presented in the experiment. However, there is evidence that even in the most artificial situations, conjoint analyses significantly reflect the decision policies actually used by individuals (e.g. Brown, 1972; Hammond & Adelman, 1976) and the possibility that respondents could attach importance to attributes merely because they were presented in the experiment is much more likely with inexperienced respondents (such as students) than with the more experienced entrepreneurs sampled here (cf. Brehmer & Brehmer, 1988). These limitations – shared by most conjoint studies – as discussed at length in Chapter 6.

Beyond issues of validity, the design on Study 1 limits the extent to which I am able to investigate and speculate as to the relative importance of the individual decision attributes (effect size). This limitation is a function of the scale employed in

the study (1-to 11, Likert-type) such that it is difficult (if not impossible) to make meaningful statements as to incremental movement from, for example, a score of 6 to a score of 7 on opportunity attractiveness. The relative importance of the decision criteria (i.e. value as compared to rarity) is an important theoretical concern which can not be adequately addressed by this study (as designed), and represents an opportunity for future research.

Also, the findings of this study may be limited – to an extent – by the nature of the sample. While a heterogeneous sample of entrepreneurs in many respects (see demographic characteristics), the sample had in common their association with a particular, regional entrepreneurship center. This shared association may suggest some homogeneity in values, belief systems, etc not represented in the larger population of entrepreneurs. As there was no means to test or control for this possible confounding influence, I cite this as a limitation of the study.

Study 2: Capturing the Construct of Metacognitive Awareness

Overview

The opportunity for scholars to employ metacognition as a theoretical lens to explore both individual and organizational performance across a wide variety of tasks and situations is limited based on the lack of ‘generalizable’ scales designed to assess an individual’s propensity to engage metacognitive processes. It is the purpose of this study (Study 2) to develop a measure of metacognitive awareness that is both easily administered, and based on the theoretical integration of conceptualizations of metacognition described in Chapter II of this dissertation. Employing Confirmatory Factor Analysis (CFA) and maximum likelihood analysis (ML), an initial solution

was obtained based on the conceptual model developed in Chapter 2 of this dissertation. Subsequent investigation of the solution focused on how these sub-constructs aggregate together to capture metacognitive awareness is evaluated using Structural Equation Modeling (SEM).

It is important to highlight that the empirical efforts here are focused on capturing a single measure representative of an individual's 'chronic' level of metacognitive awareness, and consistent with the theoretical development presented in Chapter 2 of this dissertation.

In developing the foundations of socially situated metacognition, I described it as a process representative of 5 related dimensions: metacognitive knowledge, metacognitive experience, metacognitive monitoring, metacognitive control, and a social dimension. Further, I detailed that several of these five dimensions (monitoring, knowledge, and experience) represent aggregations of additional sub-dimensions, the result of which is a 10-factor conceptualization of metacognition as a process. Metacognitive awareness is defined in this dissertation as the extent to which the individual is 'aware' and thus employ the dimensions of metacognitive processing as he/she engages in problem solving/decision tasks. Thus the logic of the 10-factor solution described in this dissertation is grounded in the suggestion any measure that purports to capture metacognitive awareness must represent all (10) dimensions of metacognitive processing, such that the extent to which each is employed can be assessed and represented as contributing to some individual's level of metacognitive awareness. Thus, the measure of metacognitive awareness

employed here is representative of a single construct (awareness) composed on multiple dimensions (10 factors).

Sample

Participants in this study included 432 undergraduate business students enrolled at the University of Colorado, Boulder. The subjects participated in this study as part of their normal course program; however administration of the instrument was done as part of a specially scheduled session outside of the normal class period. The mean age of the sample was 20.3 (*std. dev.* 1.28), and business majors represented 64% of the sample (the remaining 36% were representative of psychology, economics, political science, and undeclared majors).

Instrument Construction

Construction of the inventory began with adaptation of an instrument proposed by Schraw and Dennison (1994). Schraw and Dennison thoughtfully developed an inventory of items constructed to assess metacognitive awareness embedded within an educational context. Given that I am interested in a 'generalized' measure of metacognitive awareness not grounded in an educational context, I began the construction of the inventory by re-writing Schraw and Dennison's original items to remove the implication of an education context from each item (i.e.....When reading a book chapter in preparation for a test....), and re-focused the question of generic tasks and/or situations. Nine of Schraw and Dennison's original items were dropped entirely based on the inability to disentangle the substantive focus of the item from the educational context. Eleven additional

items were created and added to the adapted inventory, based on the theoretical dimensions of metacognition proposed in the conceptual model discussed in Chapter II of this dissertation. The resultant, initial item pool included 54 questions.

Instrument and Materials

The instrument consisted of a 54-item self-report measure designed to assess "Generalized Metacognitive Awareness." The development of the instrument was confirmatory in nature based on conceptualizations of metacognition detailed in Chapter II.

As higher order-constructs, I have proposed *a priori* five dimensions of metacognitive awareness - representative of metacognitive knowledge, metacognitive experience, metacognitive monitoring, metacognitive control, and a social dimension representative of influences of goals and motivations on activating metacognitive processing. As suggested by Flavell, however, several of these dimensions have sub-components representative of 'types' of both metacognitive knowledge and metacognitive experience. For example, metacognitive knowledge is composed of knowledge of tasks, people and strategy. Metacognitive experience is composed of one's knowledge of intuition and emotion. Monitoring is composed of two types, performance and metacognitive monitoring. The theoretical model proposes that these sub-constructs aggregate together (positively correlate) to represent each higher-order construct. The measure was constructed to capture and aggregate each of these sub-constructs into a single measure of metacognitive awareness. That is, it is not the purpose of this study to develop five different measures representing the five dimensions of metacognition, but rather to construct an instrument consistent

with the conceptual model but that captures metacognitive awareness as a unified construct.

The inventory was constructed based on a 100-mm, bi-polar scale similar to Schraw and Dennison's, anchored on the left with the statement "not very much like me," and on the right with the statement "very much like me." Schraw and Dennison suggest that the 100-mm bi-polar scale was appropriate for this type of instrument for two reasons: 1) a scale absent of all normative implications (no numerical markings) served to mitigate a normative bias in the responses, and 2) a scale based on 100-intervals served to promote variance in the measure (Schraw & Dennison, 1998). I made the decision to adopt the 100-mm scale as presented by Schraw and Dennison to address issues of normative bias described above, however I did not find the suggestion of using the scale to promote variance in the measure compelling. The variance Schraw and Dennison describe is a function of the items themselves – not the scale – and therefore how that variance is allocated to a scale (whether 1-100 or 1-5) is not relevant to the robustness of the instrument. Thus, for the purposes of scoring the instrument, the 100-mm scale was subsequently divided in 11 'quadrants,' thus an individual would receive a score between 1 and 11 for each inventory item.

The instrument (included at Appendix B) included a brief set of instructions describing the purpose of the experiment, a description of the rating scale, as well as a sample question designed to reinforce the mechanics of the scale. This sample question, presentation of instructions, and scale are depicted in Figure 4.3. The instructions also included a statement highlighting that this experiment was anonymous, confidential, and the results would not affect class grades in any way.

Figure 4.3. Sample Question and Scale – Study 2

Statement: I like to exercise early in the morning.

NOT Very Much Like Me ————— X ————— Very Much Like Me

Place an X on the line at the point that describes you

A series of additional items were included as part of the post experiment questionnaire designed to assess the nomological validity of the instrument. These scales were the short form of Cacioppo, Petty, and Kao's Need for Cognition Scale (1984), and Mehrabian's Conservatism-Liberalism Scale (1996). Both scales are attached at Appendix E and Appendix E respectively.

Critical Steps

Assessing Data Structure. In accordance with Hair, Anderson, Tatham, and Black (1998), prior to performing factor analysis it was important to ensure that the data matrix has sufficient correlations to justify the application of a factor analysis technique. Hair et al recommends applying a *measure of sampling adequacy* (MSA) as a method to quantify the degree of intercorrelations among the variables and the appropriateness of factor analysis (1998).

The MSA is an index that ranges from 0 to 1, and reaches 1 when a variable is perfectly predicted without error by the other variables. The MSA can be interpreted as follows: .80 or above, excellent; .70 or above, average; .60 or above, mediocre; .50 or below, miserable (Hair et al., 1998). Hair et al. recommends applying the MSA at

the level of the individual variable, and excluding those variables that fall in an unacceptable range from analysis (1998). It is then appropriate to look at the MSA score for the remaining data matrix as a whole, and make a determination as to whether factor analysis is appropriate given the remaining sample.

In a similar way, the Bartlett's Test of Sphericity determines whether the correlation matrix is an identity matrix, which would indicate that the factor model is inappropriate. Specifically, the Bartlett's Test of Sphericity is used to test the null hypothesis that the variables in the population correlation matrix are uncorrelated (Reiss & Judd, 2000). The significance level gives the result of the test, such that small values ($p < .05$) indicate that the data do not produce an identity matrix and, hence, are suitable for factor analysis. Larger values indicate that the data produce an identity matrix and, hence, are not suitable for factor analysis.

As such, I pre-tested the data ($n=432$) in this context by performing an anti-imaging correlation in order to obtain the MSA score at the level of the individual, inventory item. The anti-image correlation matrix represents a matrix of the partial correlations among variables after factor analysis, and conveys the degree to which the factors "explain" each other in the results. I was conservative in my application of the MSA standard, and therefore choose to exclude any variable with an MSA score of .70 or below. As a result, 12 items in total were removed from the item pool and subsequent analysis. Those items, and their corresponding MSA-statistics, are reported in Table 4.3 below:

Table 4.3. Individual Item MSA-statistics – Study 2

Item Number	MSA
4	.533
5	.634
12	.606
13	.475
15	.612
16	.554
20	.453
22	.631
26	.525
35	.599
37	.623
40	.548

Following the elimination of the above listed items, the remaining data set, consisting of 42 items, become the focus of further analysis. The resulting MSA for the remaining items as a matrix, as well as the Bartlett's Test of Sphericity, are reported in Table 4.4 below:

Table 4.4. Analysis of the data matrix – Study 2

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.848
Bartlett's Test of Sphericity	Approx. Chi-Square	6020.001
	df	630
	Sig.	.000

Employing the standards of Hair et al. (1998) to the MSA statistic of .848, the data is highly suited for the application of factor analysis techniques. In interpreting the Bartlett's Test of Sphericity, in this case the observed significance level is .000 and thus small enough to reject the hypothesis that the variables in the population correlation matrix are uncorrelated. It is concluded that the strength of the relationship among variables is strong, and therefore is appropriate to proceed with factor analysis.

Data Analysis - Assessing Significance. In assessing the significance of factor loadings, it is reasonable to adopt an approach similar to determining the

statistical significance of correlation coefficients. However, Hair et al (1998) notes research has indicated that factor loadings have significantly larger standard errors than typical correlations, thus the significance of factor loadings should be interpreted at considerably stricter levels. Further, the authors suggest that the researcher should exercise care in distinguishing between *statistical* and *practical* significance in evaluating factor loadings (1998). The authors suggest that only those loadings 'sufficiently strong' to distinguish themselves as a true cluster should be interpreted as being practically significant. Those measures that demonstrate statistically significant loadings, but that are also loadings on the margins of these strong clusters (i.e., .40 versus .70), may/should be classified as being not practically significant.

As such I will employ the idea of statistical power analysis, given the inflation of the standard errors in factor loadings, to determine the appropriate level of significance. Assuming the standard errors to be twice those of standard correlation coefficients, given a sample $n = 432$, a power level of 80%, and a significance level of .05; Table 3.2 (pg 112, Hair et al) indicates that loadings of .45 or higher are required for significance. This standard was applied only as a minimum standard given the discussion of practical versus statistical significance described above. In some cases measures which loaded significantly given the .45 threshold, but that represented an outlier given the other loading values in a particular cluster, were classified as not practically significant and thus eliminated.

Confirmatory Factor Analysis

Factor Analysis has its origins in the work of Spearman (1927, 1933) based on his application and testing of theory focused on human intellect. Thurstone (1935,

1947) further advanced both the theory and techniques representative of the foundations of factor-models by introducing methodologies designed to investigate multiple-factor constructs.

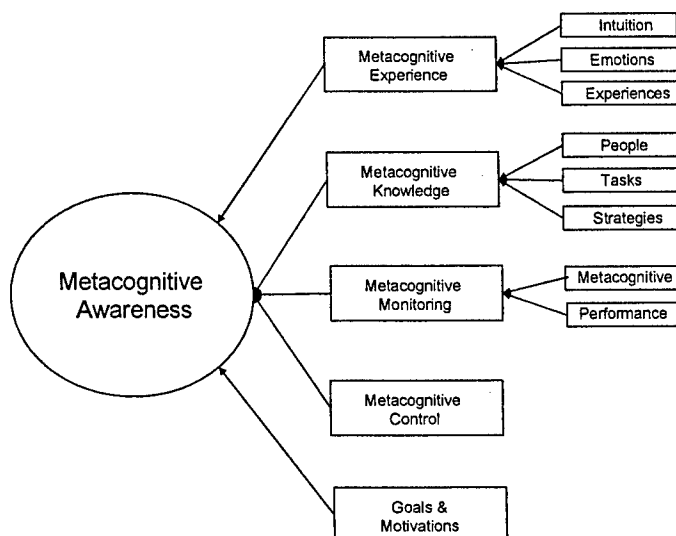
Generally, factor analysis is employed as a means to arrive at a “parsimonious understanding of a set of measured variables” (Wegener & Fabrigar, 2000), however this means has many different ‘ends’ given how factor analysis is applied across the social science disciplines. For example Rumel (1970), in his seminal work entitled *Applied Factor Analysis*, writes that factor analysis techniques are generally employed for the following purposes: 1) to investigate interdependency and pattern delineation, 2) to facilitate parsimony or data reduction, 3) to determine data structure, 4) to classify or describe, 5) to facilitate scaling, 6) for hypothesis testing, 7) for data transformation, 8) for exploration, 9) for data and construct mapping, 10) and finally for theory building.

Confirmatory Factor Analysis (CFA) is a form of theory-testing focused on confirming the existence of factors, and offers a viable method of determining construct validity such that “convergent validity, discriminant validity, random error can all be assessed within the same framework” (Reiss & Judd, 2000: 357). The approach tests a pre-determined hypothesis related to the number of constructs represented in the data, and determines how specific variables correlate to specific factors (Reiss & Judd, 2000). A minimum requirement of CFA analysis is a hypotheses as to the number of factors in the model, as well as some expectation relative to how the individual variables will load on which factors (Kim and Mueller, 1978b: 55). This is in contrast to Exploratory Factor Analysis (EFA), which is used to

simplify or ‘decompose’ a data structure so as to arrive at a determination of the number of latent constructs required to adequately account for the correlations between the measures (Wegener & Fabrigar, 2000). CFA is based on the *common factor model* that proposes that each observed response is influenced partially by underlying common factors, and partially by underlying unique factors. The strength of the relationship between the factors and the measure varies such that a given factor influences some measures more than others.

Given the theoretical development and conceptual model of situated metacognition developed in Chapter 2 of this dissertation, and thus my *a priori* hypotheses of 5 dimensions contributing to metacognitive awareness, CFA was employed to specify the solution and to determine model fit as depicted in Figure 4.4 below (10 factors aggregated to 5 dimensions aggregated to a global measure of metacognitive awareness).

Figure 4.4. Dimensions of Metacognitive Awareness



Maximum Likelihood Analysis

The parameters in confirmatory factor analysis (factor pattern, factor correlation, uniqueness) are typically estimated by maximum likelihood analysis (ML). Maximum likelihood extraction allows computation of assorted indices of goodness-of-fit (of data to the model), and the testing of the significance of loadings and correlations between factors. ML estimates are consistent and efficient, that is they are asymptotically unbiased and converge more quickly to their population values than most other estimators if the hypothesized model fits the data better than plausible alternatives. Maximum likelihood analysis requires, however, the assumption of multivariate normality (Wegener & Fabrigar, 2000). As there is not a direct test of multivariate normality offered in SPSS, Bernstein (1988) suggests that to assess whether multivariate normality has been violated, the researcher should "compute the means and standard deviations of the items on each factor. If you find large differences in means (e.g., if you find one factor includes mostly items with high response levels, another with intermediate response levels, and a third with low response levels) there is strong reason to attribute the factors to statistical rather than to substantive bases" and assume a violation of multivariate normality (p. 398). I adopted the approach suggested above to assess violations of multivariate normality, and found that the items means between factors were statistically insignificant when compared using a two-sample T-test ($p > .10$). Therefore, because multivariate normality is not violated, ML is used in this study.

Rotation

While extracting the factors will generate factor loadings, the loadings may occupy any number of orientations that can define the most general patterns of relationship in the data. The process of manipulation or adjusting the factor axes to achieve a simpler and pragmatically more meaningful factor solution is described as factor rotation. Rotated factors define *clusters* of relationships (assuming those relationships exist). Generally, rotations are either orthogonal or oblique.

Orthogonal rotations describe the best definition of *uncorrelated* cluster patterns. Employing orthogonal rotations (i.e. *varimax*, *quartimax*), the factors are extracted so that their axes are maintained at 90 degrees. Each factor is independent of, or orthogonal to, all other factors. The correlation between the factors is determined to be zero.

Oblique rotations describe the best definition of *correlated* cluster patterns. Employing oblique rotations (i.e. *promax*, *covarimin*), rather than arbitrarily constraining the factor rotation to an orthogonal (90 degree angle) solution, the oblique solution identifies the extent to which each of the factors are correlated. Rumel (1970) suggests that “oblique rotation has greater flexibility in searching out patterns regardless of their correlation.” Further, Reiss and Judd (2000) write that oblique rotations are most appropriately employed when the researcher has a theoretical basis for suggesting that a group of latent constructs – while distinct – should relate together to some higher-order dimension, and thus remain correlated. “Oblique rotations often provide a more realistic representation of how constructs are

likely to be related, as well as an estimate of the extent to which constructs are related" (Reiss & Judd, 2000; 417).

In the case of metacognitive awareness, I have suggested that there exist five dimensions of awareness (metacognitive knowledge, metacognitive experience, metacognitive control, metacognitive monitoring, and goals-motivations) that together define an individual's level of metacognitive awareness. Thus, an oblique rotation – specifically a *promax* rotation – is employed in this study.

Analysis

A restricted solution, employing maximum-likelihood and a *Promax* rotation, loaded on a ten factor solution as determined by eigenvalues greater than 1. In addition, an examination of the resulting scree plot served to confirm this finding. This solution explained 64.72% of the variance over the 10-factors. Again, recall that the instrument was constructed to capture the sub-constructs defined by the conceptual model so that they can subsequently be aggregated to a single measure of metacognitive awareness using SEM procedures. Thus, a 10-factor solution is appropriate at this stage of the analysis.

Six items did not significantly load on any one factor (or were deemed practically insignificant) and were subsequently eliminated from further analysis, resulting in a 36-item measure. The resulting factor loadings are depicted in Figure 4.5 below.

Figure 4.5. Structure Matrix – Study 2

Measure	1	2	3	4	5	6	7	8	9	10
Item Number17	0.750									
Item Number49	0.750									
Item Number51	0.701									
Item Number44	0.668									
Item Number53	0.650									
Item Number50		0.715								
Item Number54		0.569								
Item Number11		0.551								
Item Number52		0.546								
Item Number36		0.540								
Item Number43			0.630							
Item Number48			0.608							
Item Number42			0.607							
Item Number25			0.583							
Item Number21			0.572							
Item Number23			0.544							
Item Number30			0.491							
Item Number22				0.862						
Item Number08				0.735						
Item Number15				0.574						
Item Number02					0.824					
Item Number06					0.724					
Item Number03					0.566					
Item Number45						0.694				
Item Number46						0.605				
Item Number38						0.515				
Item Number33							0.815			
Item Number34							0.769			
Item Number18							0.538			
Item Number09							0.493			
Item Number37								0.796		
Item Number35								0.721		
Item Number29									0.768	
Item Number28									0.607	
Item Number47										0.706
Item Number41										0.643

Extraction Method: Maximum Likelihood. (Rotation Method: Promax with Kaiser Normalization).

Structural Equation Modeling

Correlation analysis employing Structural Equation Modeling (SEM) was then employed to determine how/if these 10 factors aggregate together given the 5 dimensions of metacognitive awareness specified in the model. For example, in the structure depicted in Figure 4.5, metacognitive knowledge is represented by three sub-constructs: 1) metacognitive knowledge of people, 2) metacognitive knowledge of tasks, and 3) metacognitive knowledge of strategy. Similarly metacognitive experience is captured by three sub-constructs (intuitions, emotions, and experiences), and monitoring by two sub-constructs (performance and metacognitive).

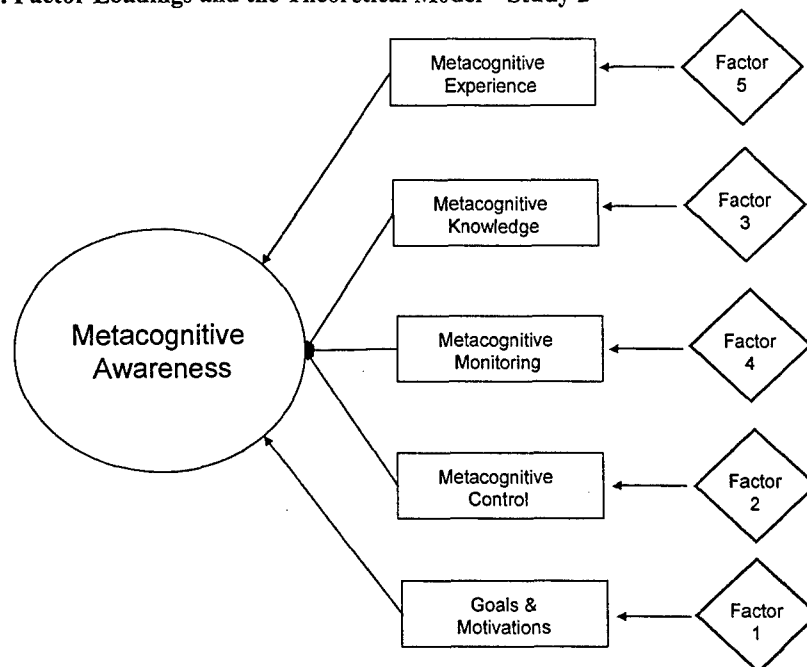
Analysis of the correlation the variables was performed using SEM to investigate both the significance level and direction of the correlations between the factors identified in the 10-factor solution depicted above. This analysis indicates a reliable five factor model as depicted in Figure 4.6.

Figure 4.6. Aggregate, Five Factor Model – Study 2

Measure	Factor				
	1	2	3	4	5
Item Number17	0.750				
Item Number49	0.750				
Item Number51	0.701				
Item Number44	0.668				
Item Number53	0.650				
Item Number50		0.715			
Item Number54		0.569			
Item Number11		0.551			
Item Number52		0.546			
Item Number36		0.540			
Item Number25			0.583		
Item Number21			0.572		
Item Number23			0.544		
Item Number30			0.491		
Item Number22			0.862		
Item Number08			0.735		
Item Number15			0.574		
Item Number02			0.824		
Item Number06			0.724		
Item Number03			0.566		
Item Number48			0.608		
Item Number45				0.694	
Item Number46				0.605	
Item Number38				0.515	
Item Number47				0.706	
Item Number41				0.643	
Item Number42				0.607	
Item Number43				0.630	
Item Number33					0.815
Item Number34					0.769
Item Number18					0.538
Item Number09					0.493
Item Number37					0.796
Item Number35					0.721
Item Number29					0.768
Item Number28					0.607

The loadings reported above, relative to the hypothesized constructs, are depicted at figure 4.7 below:

Figure 4.7. Factor Loadings and the Theoretical Model – Study 2



Correlation analysis using SEM indicates that the dimensions above are significantly correlated ($p < .05$), and those correlations are positive indicating that these five dimensions work together to capture metacognitive awareness. Specific correlations are reported concomitantly with validity statistics in a subsequent section below.

Model Fit

Goodness-of-fit index was used to determine how well the proposed model fits the data. The 'goodness-of-fit' of a factor model is assessed by comparing the observed covariance with the covariance predicted by the model. Large discrepancies between the observed covariance, and the covariance predicted by the model is indicative of poor model fit. The maximum-likelihood algorithm used to estimate the parameters in the model minimizes a chi-square statistic that compares the observed and predicted covariance. Again, the null hypothesis assumes that that the discrepancy between the observed and predicted covariance is equal to zero. In the

case of this study, the goodness-of-fit test was significant ($p < .001$), and therefore I have no basis to reject the null hypotheses that the discrepancy between the observed and predicted covariance is equal to zero.

Reliability

Reliability describes a condition where the scale yields consistent measures over time (Straub 1989). Several types of reliability are defined in the literature. Internal consistency tends to be a frequently used type of reliability applied to the social sciences. In this study Cronbach's alphas, which are calculated based on the average inter-item correlations, were used to measure internal consistency. As stated by Straub (1989, p. 151.), "high correlations between alternative measures or large Cronbach's alphas are usually signs that the measures are reliable." Table 4.xx shows the results of the reliability analysis. The Cronbach's alpha values range from 0.718 to 0.822. There is no standard cut-off point for the alpha coefficient, but the generally agreed upon lower limit for Cronbach's alpha is .70, although it may decrease to .60 (Hair et al. 1998) or even .50 (Nunnally 1978) in exploratory research. The Cronbach's alpha values for the individual dimensions are presented at Table 4.5 below:

Table 4.5. Reliabilities – Study 2

MetaKnowledge	MetaExpeireince	MetaControl	MetaMonitoring	Social
(.726)	(.718)	(.742)	(.754)	(.822)

The Cronbach's alpha value for the overall measure (between the five dimensions) of metacognitive awareness was .8849, indicating a high degree of internal consistency in this measure.

Validity

In order to demonstrate construct validity, it is necessary to demonstrate both convergent and discriminant validity in the measure. Very simply, convergent validity is demonstrated when the measures that are theoretically supposed to be highly interrelated are, in practice, demonstrated to be highly interrelated. Discriminant validity is demonstrated when the researcher can show that measures that shouldn't be related to each other are not.

Further, robust tests of validity focus on validity both within the measure (between factors) and between measures (through comparisons with other, distinct measures). Tests of validity were preformed focused both within the measure of metacognitive awareness (between factors) and through comparisons between the awareness measure and other measures (nomological validity). The ultimate solution demonstrated both convergent validity and discriminant validity.

Convergent validity within the measure can established because all the items loaded strongly on their associated factors (loading $>.50$), and each of the factors loaded stronger on their associated factors rather than on any other factors (Chau and Tam 1997).

Discriminant validity within the measure (Table 4.6) can be assessed by comparing the average variance extracted (AVE) values associated with each construct to the correlations among constructs (Staples et al. 1999). AVE "measures the percentage of variance captured by a construct by showing the ratio of the sum of the variance captured by the construct and its measurement variance" (Gefen et al. 2000, p. 66) and can be calculated by the following equation:

$$AVE = \frac{\sum X_i^2}{\sum X_i^2 + \sum (1 - X_i^2)}, \text{ where } X_i^2 = \text{the factor loading}$$

Table 4.6 Discriminant Analysis – Study 2

Constructs	MetaK	MetaE	MetaC	MetaM	Social
MetaK	.742				
MetaE	.328	.821			
MetaC	.647	.574	.743		
MetaM	.438	.673	.537	.698	
Social	.736	.348	.539	.673	.847

* **Note.** The bold diagonal elements are the square root of the variance shared between the constructs and their measures (i.e., the average variance extracted). Off diagonal elements are the correlations between constructs. For discriminant validity, the diagonal elements should be larger than any other corresponding row or column entry.

* MetaM= Metacognitive Knowledge, MetaE=Metacognitive Experience, MetaC=Metacognitive Control, MetaM=Metacognitive Monitoring, and Social=Goals & Motivations

Diagonal elements show the square root of the AVE, whereas the off-diagonal elements show the correlations among dimensions. In order to claim discriminant validity, the diagonal elements should be larger than any other corresponding row or column entry (Staples, 1999).

Finally, nomological validity (between measure validity) was established by comparing the correlations between the metacognition measure and the additional scales included for this purpose, specifically Cacioppo, Petty, and Kao's Need for Cognition Scale (1984), and Mehrabian's Conservatism-Liberalism Scale (1996). Theoretically, I would expect that individuals' score on the metacognition instrument should be correlated with scores on the Need for Cognition Scale. This was, in fact, the case with a correlation of .295 ($p < .01$) establishing convergent between measure validity. Again, theoretically I expect no significant correlation between metacognition and the individual's political orientation based on the Conservatism-

Liberalism Scale, and no significant correlation was found ($p > .10$) establishing discriminant between measure validity.

Potential Limitations

The principle limitation of factor analysis is focused on the debate in the literature as to methodological approaches to data reduction and analysis: specifically the appropriateness and utility of certain extraction and rotational methods given the purpose and nature of the analysis (exploratory vs. confirmatory; correlated vs. uncorrelated). As variables are reduced to factors, relations between the factors begin to define the relations in the variables they represent (Goldberg & Digman, 1994). Thus – many suggest – that the technique only creates hypothetical and tentative relationships as the observed data is decomposed. I note this debate as a limitation, while also highlighting that methodological choices (as to extraction method, rotation, etc) were made based on the most accepted, widely-held assumptions about factor analysis techniques in cognitive and social psychology (Reis & Judd, 2000).

I also highlight the inability of the measure itself – without some external manipulation – to capture task specific or transitory changes in metacognitive awareness. While the measure incorporates the importance of individual goals and motives on metacognitive processing (generally), it does not capture the relation between some specific goal or task (i.e. getting and 'A' on an exam), and a subsequent heightening of metacognitive awareness. This fact limits the utility of the scale to only a general measure of an individual's chronic level of metacognitive awareness.

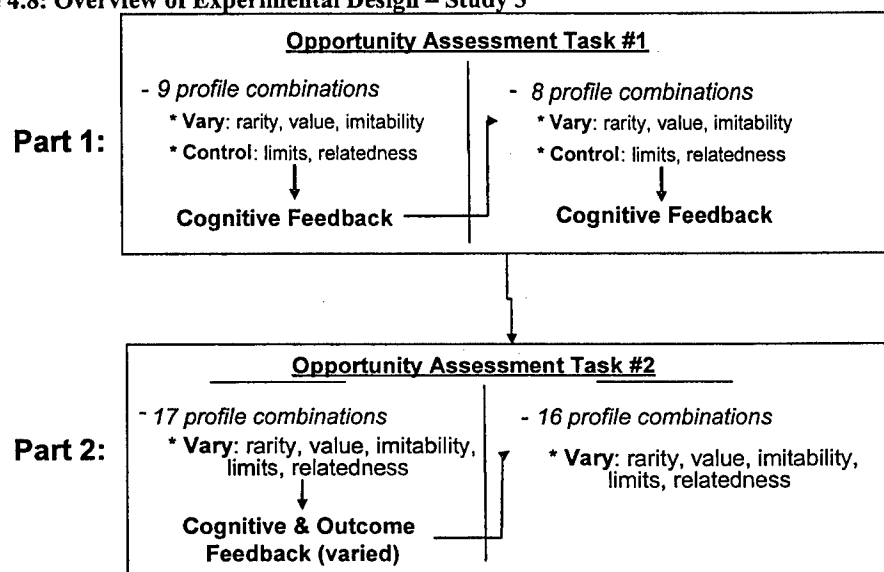
Study 3: Metacognition, Feedback, and Cognitive Adaptability

Overview

Study #3 is focused on an investigation of metacognition and feedback in promoting cognitive adaptability in the context of an entrepreneurial task. Given the many steps and stages associated with this study, I will first provide a simple overview of the experimental design, and then in subsequent sections detail specific measures, manipulations, and procedures.

Given that this study employs conjoint analysis in a similar manner as did Study #1, to avoid repetition discussion of conjoint techniques here will be limited to only those procedures which represent departures from those employed in Study #1. In this overview, and throughout this section, I will discuss the study in two parts consistent with Figure 4.8:

Figure 4.8: Overview of Experimental Design – Study 3



In **Part 1** of this study (Study 3) I engage a sample of individuals inexperienced at performing entrepreneurial tasks in an opportunity assessment exercise – and in doing so train these individuals to internalize a ‘simple’ model of the relationship between a set of assessment criteria and their own assessments of opportunity attractiveness. Subjects will 1) evaluate a series of 8 opportunity profiles, 2) receive cognitive feedback focused on providing a basis for comparing their decision policies to what they will be told is an ‘optimal’ model (i.e., the simple base model), and 3) repeat step one (the entrepreneurial task). I employ a fully replicated, orthogonal fractional factorial design with three assessment criteria at two levels (high and low). This design allowed me to test for all main effects using only four profiles. I used one practice profile and replicated the four original profiles both before and after feedback was presented, therefore each inexperienced entrepreneur evaluates 17 profiles in total. The purpose of Part 1 is to facilitate the development of a simple decision policy of opportunity assessment, from which I will subsequently (in Part 2 of this study) investigate the role that both metacognition and feedback (main-effect and contingent relationships) play in promoting adaptation *away from* that ‘simple base’ model given disconfirming feedback from the environment as to the ‘appropriateness’ of their decision policies.

In **Part 2** subjects engage in a second opportunity assessment task, different from the task performed in Part 1 in several, important regards. First, all five section criteria will vary (as opposed to only three), requiring 16 profiles and one practice (as opposed to only 9 profiles in Part 1). In other words, the conjoint experiment in study 2 is the same as the conjoint experiment used in study. Second, in part 2 of study 3

the individuals inexperienced at entrepreneurial tasks will randomly receive *either* cognitive or outcome-based feedback after completing the first conjoint experiment but before beginning the second (identical) conjoint experiment (i.e., after the first 32 profiles). Finally, in order to investigate cognitive adaptability, the 'simple base' model of optimal performance – against which performance on the task was measured in Part 1 – is now abandoned in favor of the more complex model that was used by the sample of entrepreneurs from Study #1. This "expert" model is more complex than the simple base model because: 1) it has more criteria to consider, 2) feedback suggests that these criteria should not be equally weighted, and 3) that the impact of three of the criteria on the assessment depends on the level of a fourth criterion (three two-way interactions). As such, feedback provided to the subjects in Part 2 of this study will be based on the expert model.

Detailed discussions as to experimental design considerations, sample, variables, and procedures are presented below – again organized as Parts 1 and 2 of this study.

Sample

Participants in this study include 217 undergraduate business students enrolled at the University of Colorado. Participation in this study occurred as part of their normal course program; however administration of the experiment was accomplished as part of a specially scheduled session in a laboratory setting where conditions can be controlled. 55% of the sample were male, the average age was 20.44 (*std. 1.48*), and 87% were business majors. I characterize this sample as consistent with individuals inexperienced to performing entrepreneurial tasks.

As the aim of this study is to explore cognitive adaptability enabled by metacognition and in the performance of opportunity assessment (an entrepreneurial task), a sample with limited prior knowledge or experience in performing opportunity assessment serves to mitigate potentially confounding effects that prior knowledge and experience may have on the dependent variable – cognitive adaptability. Further, given the psychological nature of the constructs examined in this dissertation, precedence exists for utilizing student samples for this type of research even within management research. For example, Audia, Locke, and Smith (2000) write that that student samples represent a meaningful ‘first step’ in exploring the psychological basis for managerial behaviors. I suggest that the sampling frame employed here serves that end.

In addition to the questions that captured the demographic characteristics reported above, participants also completed three assessment measures: 1) the metacognition scale developed in Study #1, 2) the short form of Cacioppo, Petty, and Kao’s Need for Cognition Scale (1984), and Higgins’s Regulatory Focus Measure (2001).

Theory and research suggest that the extent to which an individual is motivated to perform on a given task, as well as their capacity and propensity to engage in cognitively complex tasks may relate to cognitive adaptability as I have conceptualized it in this dissertation. Thus, the Need for Cognition Scale and the Regulatory Focus measure were selected to serve as control variables.

Part 1 of Study 3: Design, Variables, and Levels

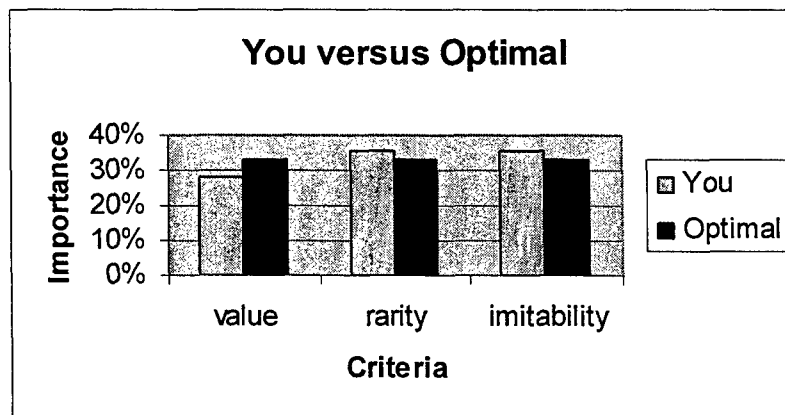
The first administration of the opportunity assessment task is a fully replicated orthogonal fractional factorial design as described in Study 1 presented in above, where a sample of entrepreneurs evaluated the ‘attractiveness’ of hypothetical opportunity scenarios based on a set of resource-based criteria. However, in Part 1 of *this study*, I vary only three of the five assessment criteria – specifically value, rarity, and imitability – and hold constant relatedness and limits on competition in a ‘low’ condition. As such, to establish the “simple base” decision policy with individuals inexperienced at entrepreneurial tasks, I used an orthogonal fractional factorial design for three criteria at two levels. This design allowed me to test for all main effects using only four profiles. I used one practice profile and replicated the four original profiles. As such, subjects evaluate nine profiles - receive feedback – and evaluate a second set of eight profiles (no practice profile). In total, subjects evaluate 17 profiles in Part 1 of study 3.

Feedback

Feedback type was exclusively cognitive in Part 1 of study 3. The profiles are presented to inexperienced entrepreneurs on a computer screen, and they are asked to indicate their assessment electronically. Cognitive feedback was computer generated, and presented to the inexperienced entrepreneur half-way through the task (after the first 8 profiles). The goal of this cognitive feedback is to ‘train’ the subjects to adopt a specific ‘simple base decision policy’ of opportunity assessment. That is, the feedback is designed to direct inexperienced entrepreneurs to use all three decision criteria and to weight them consistent with the feedback presented. The optimal

model criteria weights (against which individual performance was compared and feedback generated) were as follows: Value: 10%, Rarity: 30%, and Imitability: 60%). I arbitrarily assigned these weights, being careful that the weights assigned to the feedback model here were meaningfully different than the weights validated in the expert model – Study 1. As the purpose of Study 3 is to investigate cognitive adaptability – evolving decision policies from *point A* to *point B* – it was important to assign weights to the false model that offered the inexperienced entrepreneurs the opportunity to adapt when presented with an alternative weighting framework. Beyond this concern (that the weights assigned here are meaningfully different from the weights in the expert model), the arbitrary nature of the criteria weights in Part 1 of Study 3 is sensible and not problematic in any way. As inexperienced entrepreneurs, the respondents in this study have no pre-conceptions as to how these criteria normatively ‘should’ be weighted. An example of the character of the feedback presented to the subjects in Part 1 of this study is at Figure 4.6:

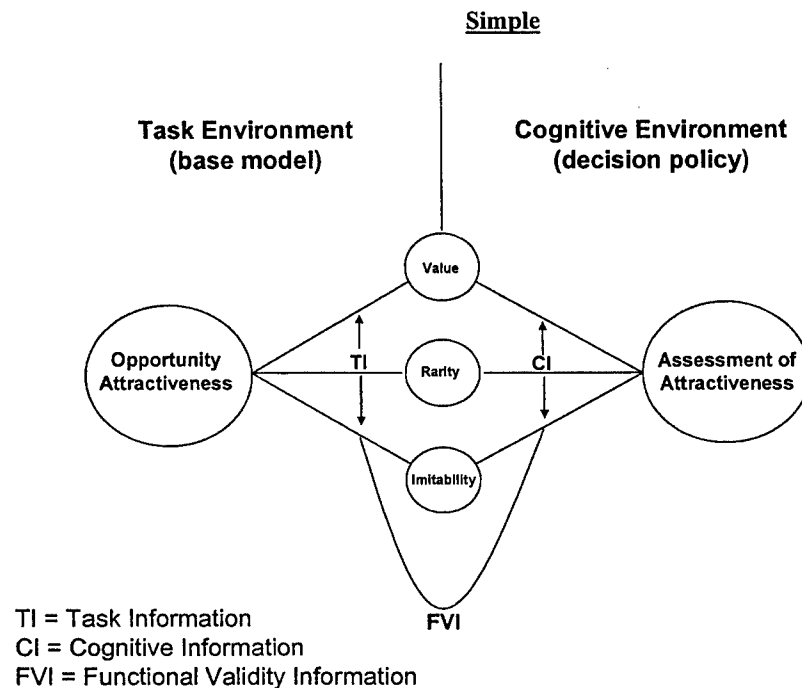
Figure 4.9 Cognitive Feedback: Part 1 of Study 3



The relationship I propose between the types of feedback described and presented to the inexperienced entrepreneurs - the simple base model, and their own

assessments of opportunity attractiveness - was developed by Blazer et al. (1994) within the context of the Lens Model (Brunswick, 1956). Those relationships are depicted in Figure 4.10 below:

Figure 4.10. Types of Cognitive Feedback and the Simple Entrepreneurial Task



Consistent with the findings of Blazer et al. (1994), the cognitive feedback presented in Part 1 of this study – while simple as presented – contains each of the components to satisfy the definition of cognitive-type feedback:

1. **Task Information (TI)** describes the relationships between the criteria and opportunity attractiveness - the optimal relationship between the criteria and the attractiveness of an opportunity (i.e., equal weighting of the three criteria consistent with the simple base model).
2. **Cognitive Information (CI)** provides information about the individual's decision policy, presented as a graph depicting the relationship between the three criteria and their assessment of opportunity attractiveness.

3. **Functional Validity Information** (FVI) provides information about the relationship between the task (assessment) and the individual's decision policy.

Variables

In conjoint analysis, theoretical justification for the variables is essential because conjoint analysis requires judgment attributes to be known *a priori*. The theoretical justification for each of the variables applied in Part 1 of this study, as well as their operationalizations, is described in detail in the research methods section for Study 1. In study 3 the dependent variable is derived from the output of the conjoint studies.

Dependent Variable. The dependent variable should capture both how feedback and metacognition promote change in a given decision policy, as well as the normative implication of that change. Consistent with this purpose I used a measure of Average Change Accuracy (Avg. Accuracy), which is calculated as follows for Part 1 of study 3:

Figure 4.11. Dependent Variable Calculation for Part 1 of Study 3

$$\begin{aligned}
 & (\text{ABS}(\text{Weight}^{\text{Value}}_{t_1} - \text{Weight}^{\text{Value}}_{\text{opt}})) - (\text{ABS}(\text{Weight}^{\text{Value}}_{t_2} - \text{Weight}^{\text{Value}}_{\text{opt}})) \\
 & (\text{ABS}(\text{Weight}^{\text{Rarity}}_{t_1} - \text{Weight}^{\text{Rarity}}_{\text{opt}})) - (\text{ABS}(\text{Weight}^{\text{Rarity}}_{t_2} - \text{Weight}^{\text{Rarity}}_{\text{opt}})) \\
 & (\text{ABS}(\text{Weight}^{\text{Limit}}_{t_1} - \text{Weight}^{\text{Limit}}_{\text{opt}})) - (\text{ABS}(\text{Weight}^{\text{Limit}}_{t_2} - \text{Weight}^{\text{Limit}}_{\text{opt}})) \\
 & \textbf{Average change accuracy} = \frac{\text{Accuracy}_{\text{Value}} + \text{Accuracy}_{\text{Rarity}} + \text{Accuracy}_{\text{Limitability}}}{3}
 \end{aligned}$$

As depicted above, regression is used to determine individual, standardized coefficients – as weights – for each of the three decision criteria employed in the

study: Rarity, Value, and Imitability. Weight depicted at t_1 represents the respondent's decision weight for a given attribute *prior to receiving feedback*. Weights depicted at t_2 represent the respondent's decision weight for a given attribute *after receiving feedback*. As part of the above calculation, both before and after receiving feedback the individual decision weights for each attribute are compared to the 'optimal' decision weight (represented with the subscript $_{opt}$) to determine the 'GAP' in decision weight:

$$\left\{ \begin{array}{c} (\text{WeightValue}_{t_1} - \text{WeightValue}_{opt}) \\ \text{GAP 1, Value} \end{array} \right\} \quad \left\{ \begin{array}{c} (\text{WeightValue}_{t_2} - \text{WeightValue}_{opt}) \\ \text{GAP 2, Value} \end{array} \right\}$$

The absolute value of GAP 1 (pre-feedback) is then subtracted from the absolute value of GAP 2 (post-feedback), resulting in an accuracy score for a given individual on a given attribute (i.e. Value, Rarity). This score represents normative movement towards the optimal weight for the given criteria – put simply, the degree to which the individual moved closer to the optimal weight following feedback (as compared to prior to receiving feedback). Higher and positive average change accuracy scores depict normative improvement. Average change accuracy then is represented by the average of the accuracy scores of the three decision attributes:

$\text{Average Change Accuracy} = \frac{\text{Accuracy}_{\text{Value}} + \text{Accuracy}_{\text{Rarity}} + \text{Accuracy}_{\text{Imitability}}}{3}$
--

Independent Variables. As hypothesized, my interest is focused on the role that metacognition and feedback type play in promoting cognitive adaptability. As

such, modeling is focused on the relationship between both metacognition and feedback type with average change accuracy.

Again, theory and research suggest that the extent to which an individual is motivated to perform on a given task, as well as their capacity and propensity to engage in cognitively complex tasks may relate to cognitive adaptability as I have conceptualized it in this dissertation. Thus, the Need for Cognition Scale and the Regulatory Focus measure were selected to serve as control variables in the model. Please note that feedback is not manipulated in part 1 of study 3, all individuals receive cognitive feedback.

- **Metacognition:** metacognition was captured using the measure developed in Study 2 of this dissertation, and employed as a continuous variable in the regression analysis.
- **Need for Cognition:** Cacioppo, Petty, and Kao (1982) developed a Need for Cognition Scale that measures how much people enjoy engaging in effortful cognitive activities. Individuals who rank high in "need for cognition" enjoy thinking and do it more often than individuals who rank low in this area and who only engage in careful thought when they have to. The scale has 18 items arranged in a Likert-scale fashion. The measure is attached at Appendix D.
- **Regulatory Focus:** Regulatory focus theory (Higgins, 1997) distinguishes between a promotion focus (hopes and accomplishments – gains) and a prevention focus (safety and responsibilities - non-losses). Promotion and prevention orientations can be chronic or they can be induced by some situation. Individuals' chronic promotion and prevention orientations can be measured using the

Regulatory Focus Questionnaire (RFQ) (Higgins, Friedman, Harlow, Idson, Ayduk, and Taylor, 2001). This 11-item questionnaire measures both varying levels of promotion motivation and, independently, varying levels of prevention motivation. This measure is attached at Appendix C.

Part 2 of Study 3: Design, Variables, and Levels

In Part 2, the inexperienced entrepreneurs will engage in a second opportunity assessment task more complex in character to the first (from three to five criteria). However, in Part 2 of Study 3, the feedback presented to the inexperienced entrepreneurs will be focused on migrating their decision policies away from the 'simple base' model of evaluation employed in Part 1 of Study 3, and toward a model of opportunity assessment consistent with the findings of Study 1 (based on the decision policies of entrepreneurs). Feedback type varies between cognitive and outcome based feedback (developed more fully below). Again, progress toward that goal (migrating subject's decision policies away from the 'base' model of assessment and towards the expert model) can be assessed using OLS regression.

Variables

Dependent Variable. The dependent variable is essentially the same measure described in Part 1 with the exception of the number of assessment attributes which combine to make up the individual's decision policy. In Part 2 of this study, 5 opportunity attributes combine to make up the individual's decision policy: Value, Rarity, Imitability, Limits of Competition, and Relatedness. In addition, the respondents receive feedback on 3 additional, contingent relationships.

As depicted in Figure 4.11, regression is used to determine individual, standardized coefficients – as weights – for each of the five decision criteria employed in the study: Rarity, Value, Limits, Imitability, Relatedness, and the three contingent relationships (Relatedness * Value, Relatedness * Rarity, and Relatedness * Limits on Competition). Weights at t_1 represent the respondent's decision weight for a given attribute *prior to receiving feedback*. Weights at t_2 represent the respondent's decision weight for a given attribute *after receiving feedback*. As part of the above calculation, both before and after receiving feedback the individual decision weights for each attribute are compared to the 'optimal' decision weight (represented with the subscript o) to determine the 'GAP' in decision weight. The absolute value of each GAP (pre-feedback) is then subtracted from the absolute value of the corresponding attribute GAP (post-feedback), resulting in an accuracy score for a given individual at a given attribute (i.e. Value, Rarity, etc.). This score represents normative movement towards the expert weight for the given criteria – put simply, the degree to which the individual moved closer to the expert weight following feedback (as compared to prior to receiving feedback). Average Change Accuracy then is represented by the average of the accuracy scores of the eight decision attributes. Higher and positive average change accuracy scores depict normative improvement.

It is worth highlighting here that the possibility exists that because Average Change Accuracy represents a 'difference score,' the data may exhibit a moderate to high degree of measurement error (inflated error). If such error exists, the reliability of the data becomes questionable. However, it is possible to assess the extent to

which such inflation or error may be represented in the data (given a difference measure as the DV) by investigating the distribution of variable in question. Negatively skewed data, or data where the mean is centered on zero, highlight a potential problem with inflated error due to the difference measure. If one or both of these indications are true of the data, additional transformations may be required (Reis & Judd, 2001). However, in both Part 1 and Part 2 of Study 3 a visual examination of a histogram plotting the average change accuracy data revealed that the scores were not negatively skewed, and the mean scores in both parts were not centered on zero. This analysis provides an assurance that inflation of error due to difference measure is not a serious issue in this study.

Independent Variables. In Part 2 of Study 3 the focus is on the role of metacognition and feedback in promoting cognitive adaptability. Operationalizations of each are discussed below. As in Part 1 of this Study, participants also completed 1) Cacioppo, Petty, and Kao's Need for Cognition Scale (1984), and 2) Higgins's Regulatory Focus Measure (2001) to be included in the model as control variables. As these control variables were detailed in Part 1 of Study 3, they will not be revisited here.

- **Metacognition:** metacognition was captured using the measure developed in Study 2 of this dissertation, and employed as a continuous variable in the regression analysis.
- **Feedback:** feedback type was randomly assigned as either cognitive or outcome based, codes .5, and -.5 respectively. The profiles are presented to inexperienced entrepreneurs on a computer screen, and they are asked to indicate their assessment

electronically. Both cognitive and outcome feedback were computer generated, and presented to the inexperienced entrepreneur half-way through the task (after the first 17 profiles).

The goal of this cognitive feedback is to 'train' the subjects to abandon the 'simple base decision policy' of opportunity assessment. That is, the feedback is designed to direct inexperienced entrepreneurs to use all five decision criteria, as well as make them aware of the contingent relationships between certain criteria, and to weight them consistent with the feedback presented. The expert model criteria weights (against which individual performance was compared and feedback generated) were consistent with the finding of Study 1.

The cognitive feedback provided will be identical in nature to the cognitive feedback described in Part 1 of this study. Outcome feedback will consist only of a numerical score that represents the percentage of the respondents' assessments that are in agreement with that of the expert model. An example of the presentation of the outcome feedback is at Figure 4.13:

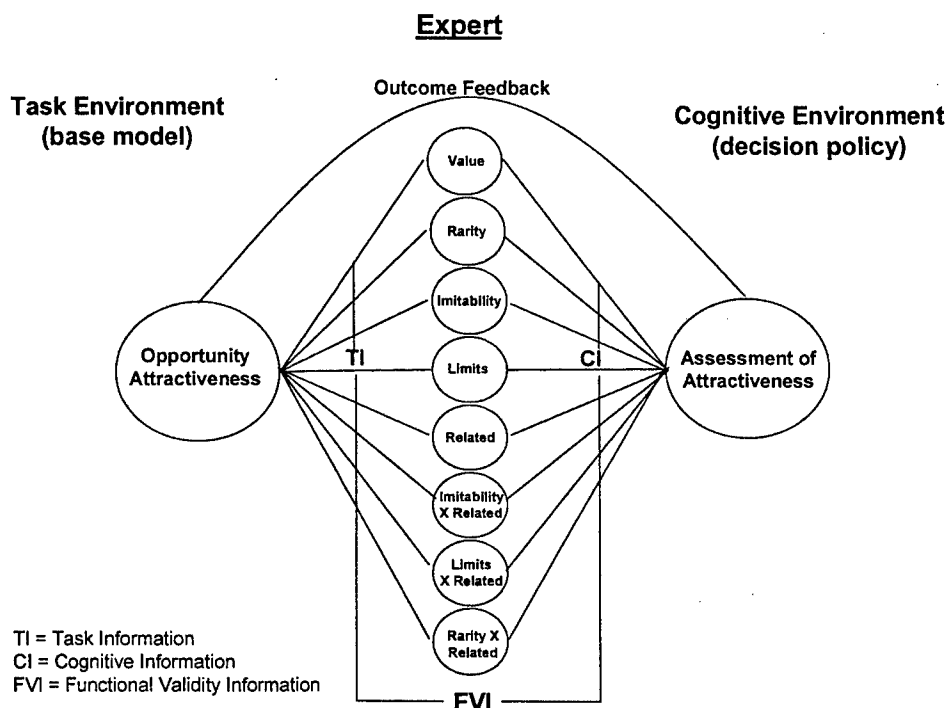
Figure 4.13. Outcome Feedback Example – Part 2 of Study 3

Your score is 39%. This means that 39% of your answers (scores of attractiveness on each profile) are consistent with the scores of expert entrepreneurs.

Agreement for outcome feedback is considered to be reached if the inexperienced entrepreneur's assessment is within plus or minus one scale point from that of experts on a given scenario. For example, if an individual respondent, in the process of assessing the 33 scenarios, scores 22 of the 33 within one point of the

expert, he or she will receive an 'outcome' score of 66%. Again in the context of the Lens Model, the relationships which characterize both outcome and cognitive feedback are depicted below in Figure 4.14:

Figure 4.14. Types of Cognitive Feedback and the Complex Entrepreneurial Task



Hierarchical Regression Analysis

Hierarchical Regression is employed to test the relationships hypothesized in Study 3. Hierarchical Regression (Tabachnick & Fidell, 1983) can be effectively employed to investigate the relationship between a set of independent variables and the dependent variable, 'over and above' the impact of a different set of independent variables on the dependent variable. In hierarchical regression, the independent variables are entered into the analysis in a sequence of blocks, or groups, which may contain one or more variables. As such, it becomes possible to demonstrate the

amount of variance in the dependent explained by one (or a set) of new independent variables, over and above that explained by an earlier set. Consider this simple example:

$$\text{Base Model (Block 1):} \quad Y = B_0 + B_1X_1 + \epsilon$$

$$\text{Block 2:} \quad Y = B_0 + B_1X_1 + B_2X_2 + \epsilon$$

Employing hierarchical regression analysis, the ΔR^2 reported at Block 2 represents the amount of variance in Y accounted for by X_2 when controlling for X_1 . This technique is consistent with the theoretical motivations for this research, in that my focus is on whether or not metacognitive awareness and feedback type explain a significant amount of variance in Average change accuracy (over and above the control variable) . Further, I am interested to test whether the multiplicative relationship between metacognition and feedback (the interaction between metacognition and feedback) is significant in explaining variance in Average change accuracy over and above the main effect only relationships – thus addressing the question of whether those individuals high on metacognition use feedback ‘differently’ than others. Given the interaction I have suggested, an additional discussion of the appropriateness of employing hierarchical regression to investigate interaction terms is warranted

Writing in a special issue of Journal of Management devoted exclusively to statistical issues in management research, Bobko and Russell (1994) note that “there is some controversy in the statistical literature regarding the analysis of interaction terms,” highlighting that “some researchers mistakenly analyze just the bivariate relationship between the dependent variable and the cross-product term (Evans, 1990;

Bobko & Russell, 1994). The authors assert that “the burden of proof is on demonstrating that the interaction adds unique explanatory power over and above main effects,” and that to include only the interaction term in the model “confounds main effects and interactions and is not congruent with the field's usual appeal to parsimony (Bobko & Russell; Cohen & Cohen, 1983). By employing hierarchical regression in this study, I am able to investigate the unique explanatory power of the hypothesized, non-linear relationship I suggest between metacognition and feedback - ‘over and above’ the main effects of those variables alone - in a way consistent with conventions and recommendations detailed above. Thus, I suggest that hierarchical regression is uniquely suited to investigate the series of hypotheses developed in this study.

Summary

This chapter detailed the methodological approach for addressing the hypotheses raised in chapter three. To test these hypotheses, three procedures were employed: 1) a conjoint analysis experiment conducted with successful entrepreneurs, 2) a scale to measure Metacognitive Awareness was developed employing Confirmatory Factor Analysis, and 3) a conjoint analysis experiment conducted with a large sample of inexperienced entrepreneurs. These three procedures, in addition to the demographic portfolios collected from each sample, allowed for a complete analysis. The methodology section began with the operational definitions of the variables, a discussion of the sample, and a discussion of the procedures used to collect data for each of the three studies. The chapter concluded with an integrative discussion of the three studies.

CHAPTER 5

RESULTS

Introduction

This chapter of the dissertation reports the research results. I will begin this chapter by reporting the results of Study #1, which was designed to establish a model of 'expert' opportunity assessment such that this model can be employed in Study #3. I will then move to report the findings from Study #3, detailing the impacts of feedback and metacognition on evolving entrepreneurial decision policies and promoting cognitive adaptability. The results of Study 2, the construct validation of the metacognitive awareness measure, are reported in Chapter 4 and therefore Study 2 is not addressed specifically in this Chapter.

An Entrepreneurial Task – Study #1

Overview of Study 1

In Study 1 I have hypothesized that entrepreneurial opportunity evaluation proceeds based on a cognitive assessment of the potential benefits that may be conferred as a result of opportunity exploitation. Further, I have suggested that this cognitive assessment is influenced by the extent to which the resources that result from exploitation are related to existing resource endowments of the entrepreneur. Thus, the focus of this study is to investigate how resource characteristics are used by entrepreneurs when assessing the attractiveness of opportunities. The following serves to detail the results of this first study.

Individual Level Results of Study 1

Appendix F presents a table that details the decision policies of each individual. An example of the statistics reported for each individual in the sample is depicted at Figure 5.1.

Figure 5.1. Example of statistics reported at Appendix F.

1	2	3	4	5	6	7	8	9	10	11
Person	β Value	t-ratio	β Rarity	t-ratio	β Imitability	t-ratio	β Limits	t-ratio	β Relate	t-ratio
1	0.37	2.29	0.17	1.09	-0.56	-4.95	-0.10	-0.60	0.38	1.71

12	13	14	15	16	17	18	19	20	21	22
β Rel*Rarity	t-ratio	β Rel*Value	t-ratio	β Rel*Imitability	t-ratio	β Rel*Limits	t-ratio	R ²	F-value	Reliability
-0.03	-0.17	-0.03	-0.17	-0.03	-0.17	0.23	1.194	0.71	6.94	0.757

From left to right, column one of this table indicates individual (in this example, person #1), and columns two through nineteen report - for Person #1 - the standardized coefficient and relevant t-statistic for each of the assessment criteria employed in Study 1 (Value, Rarity, Imitability, Limits on, and Relatedness), as well as the standardized coefficient's relevant t-statistic for each of the hypothesized, contingent relationships (Relatedness*Rarity, Relatedness*Value, Relatedness*Imitability, and Relatedness*Limits on Competition). Columns twenty and twenty-one report the R² and F-statistic for person number one's decision policy, and finally column twenty-two reports person #1's test re-test reliability.

98 percent of the individual models of entrepreneurs' evaluations explained a significant proportion of variance ($p < .05$) with a mean R² of .83 (which is consistent with Choi's and Shepherd's [2004] 95% of significant individual models and a mean adjusted R² of .78). Pearson R correlations were computed between each participant's evaluation of both the original and the 16 replicated profiles within the

conjoint experiment. 89.3 percent of the entrepreneurs were significantly reliable in their responses ($p < .01$) with a mean test-retest correlation of .79 (consistent with Shepherd [1999], which found 92% of venture capitalists with significantly reliable responses and a mean test retest correlation of .69). This high degree of judgmental consistency provides assurance that the conjoint task was performed consistently by the entrepreneurs.

Aggregate Results of Study 1

Although the experiment provides thirty-two observations per entrepreneur and therefore 2,336 observations for the sample, there may be autocorrelation because each set of 32 observations is nested within individuals. Hierarchical linear modelling (HLM) accounts for the possible impact of autocorrelation. In this study I report only the full model rather than two sets of results - one model for the main-effects-only and one for the main-effects and the interactions. This reporting of results is consistent with other studies that have used orthogonal fractional factorial designs for metric conjoint analyses (cf. Priem, 1994; Priem & Rosenstein, 2000). Because the research design assures there is zero correlation between the independent variables, testing and subsequently reporting two models (main-effects and full) is neither necessary nor appropriate.

Table 5.1 is representative of the decision policy of the sample of entrepreneurs towards evaluating the attractiveness of entrepreneurial opportunities, represented by coefficients (standardized) for each of the decision attributes (value, rarity, imitability, limits on competition, relatedness), as well as coefficients for the interactions between relatedness and the resource-based decision criteria. For each

coefficient, the corresponding standard error, t-ratio and level of significance (indicated by the number of asterisks following the t-ratio) are presented.

Table 5.1. Conjoint Results of Entrepreneurs' Opportunity Assessment - Study 1

Evaluation Criteria	Coefficient	Std. Error	t-ratio
H1: Value	3.02	.123	24.69***
H2: Rarity	1.21	.063	19.19***
H3: Inimitability/non-substitutability	0.29	.146	2.03**
H4: Limits to competition	1.78	.122	14.60***
H5: Relatedness	2.27	.119	19.13***
H6: Value x Relatedness	1.10	.195	5.63***
H7: Rarity x Relatedness	-.488	.146	-3.34***
H8: Inimitability x Relatedness	-.080	.141	-0.56
H9: Limits x Relatedness	-.228	.097	-2.33*
<i>Intercept</i>	5.47	.079	69.13***

*p<.05; **p<.01; ***p<.001; n=2,336 decisions nested in 73 entrepreneurs

For the sample as a whole, 97.5% of the variance in decisions is within individual variance, that is, only 2.5% of the variance in decisions is from individual differences (between individual variance). 76.6% of the true within individual variance is accounted for by the variables of this study. As demonstrated in Table 5.x, all main effects were significant, positive, and employed by the entrepreneurs in their evaluation of the attractiveness of opportunities. Specifically, the positive coefficient for: 1) value indicates that the more valuable an opportunity (at least in terms of improvements in organizational efficiency and effectiveness) the greater its evaluated attractiveness; 2) rarity indicates that the more rare an opportunity the greater its evaluated attractiveness; 3) inimitability indicates that the more inimitable and non-substitutable an opportunity the greater its evaluated attractiveness; 4) limits to competition indicates that the more an opportunity provides a defensible position against competitors the greater its evaluated attractiveness; 5) relatedness indicates that the more related an opportunity is to the knowledge, skills, and abilities of the

entrepreneur the greater its evaluated attractiveness. This final finding for relatedness provides support for Hypotheses 1.

However, as hypothesized the decision policies of the entrepreneurs appear to be more complex than simply the independent relationships described above. Three of the four hypothesized interactions were significant. To aid in the interpretation of these significant relationships, high and low levels of relatedness are plotted on a y-axis for evaluated attractiveness of opportunities (the dependent variable), and high and low levels of each relevant decision criteria are plotted on an x-axis.

Figure 5.2 plots the significant interaction between value and relatedness, and indicates that the more valuable an opportunity, the more positively an entrepreneur is likely to evaluate that alternative although this relationship is more positive when the opportunity's relatedness to the entrepreneur's existing knowledge, skills, and abilities is high than when it is low. The nature of this relationship provides support for Hypothesis 2.

Figure 5.2. Value x Relatedness and Opportunity Assessment – Study 1

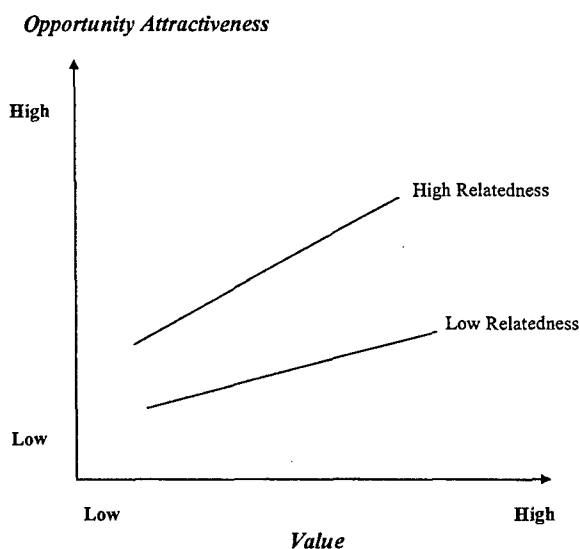


Figure 5.3 below plots the significant interaction between rarity and relatedness, and indicates that the more rare an opportunity, the more positively an entrepreneur is likely to evaluate that alternative although this relationship is *less* positive when the opportunity's relatedness to the entrepreneur's existing knowledge, skills, and abilities is high than when it is low. The nature of this significant relationship does not support Hypothesis 3.

Figure 5.3. Rarity x Relatedness and Opportunity Assessment – Study 1

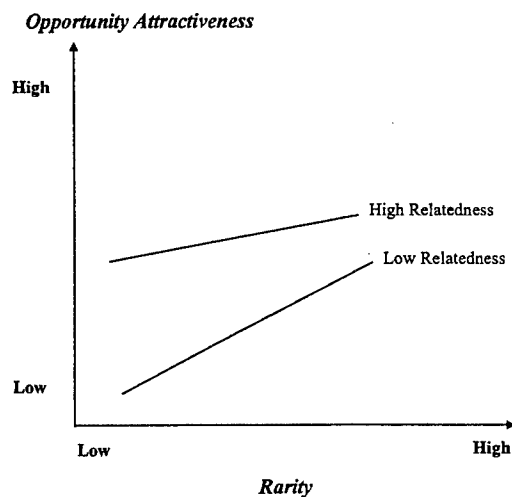
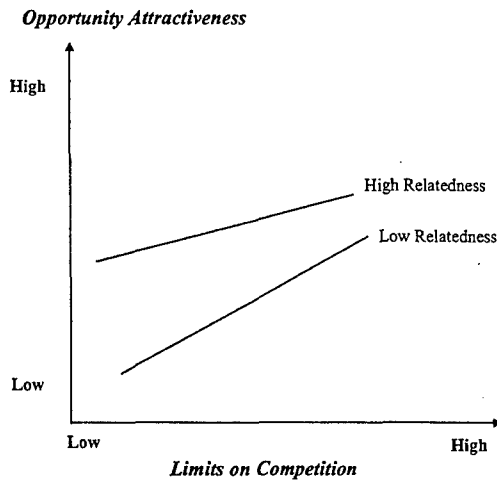


Figure 5.4 below plots the significant interaction between limits to competition and relatedness, and indicates that the higher limits on competition for the future market position for an opportunity, the more positively an entrepreneur is likely to evaluate that alternative, and this relationship is less positive when the opportunity's relatedness to the entrepreneur's existing knowledge, skills, and abilities is high than when it is low. The nature of this significant relationship does not provide support for Hypothesis 5.

Figure 5.4. Limits x Relatedness and Opportunity Assessment – Study 1



There was no significant interaction between inimitability and relatedness, and therefore Hypothesis 4 was not supported. A summary of results relating the hypotheses developed in Chapter 3 of this dissertation to the findings of this study is presented at Figure 5.5 below:

Figure 5.5. Summary of Results – Study 1

<u>Hypotheses</u>	<u>Support</u>
H1: The more related an opportunity to the entrepreneur's existing knowledge, skills, and abilities, the more positively an entrepreneur is likely to evaluate that alternative.	Supported
H2: The more valuable an opportunity, the more positively an entrepreneur is likely to evaluate that alternative although this relationship is more positive when the opportunity's relatedness to the entrepreneur's existing knowledge, skills, and abilities is high than when it is low.	Supported
H3: The more rare an opportunity, the more positively an entrepreneur is likely to evaluate that alternative although this relationship is more positive when the opportunity's relatedness to the entrepreneur's existing knowledge, skills, and abilities is high than when it is low.	Not Supported (significant but in a direction not hypothesized)
H4: The less imitable an opportunity, the more positively an entrepreneur is likely to evaluate that alternative, and this relationship is more positive when the opportunity's relatedness to the entrepreneur's existing knowledge, skills, and abilities is high than when it is low.	Not Supported
H5: The higher limits on competition for the future market position for an opportunity, the more positively an entrepreneur is likely to evaluate that alternative, and this relationship is more positive when the opportunity's relatedness to the entrepreneur's existing knowledge, skills, and abilities is high than when it is low.	Not Supported (significant but in a direction not hypothesized)

Construct Validation of a Metacognitive Awareness Scale – Study #2

The full results of the construct validation of the metacognitive awareness index are reported in Chapter 4 of this dissertation. In summary, the scale demonstrated sufficient reliability and validity to justify the use of the measure in Study 3, reported below.

Metacognition, Feedback, and Cognitive Adaptability – Study #3

Overview of Study 3

Study 3 is focused on an investigation of metacognition and feedback in promoting cognitive adaptability in the context of an entrepreneurial task.

In **Part 1** of Study 3, I engage a sample of individuals inexperienced at performing entrepreneurial tasks in an opportunity assessment exercise – and in doing so train these individuals to internalize a ‘simple’ model of the relationship between a set of assessment criteria and their own assessments of opportunity attractiveness. The purpose of Part 1 is to facilitate the development of a simple decision policy of opportunity assessment, from which I will subsequently (in Part 2 of this study) investigate the role that both metacognition and feedback (main-effect and contingent relationships) play in promoting adaptation *away from* that ‘simple’ model given feedback from the environment as to the ‘inappropriateness’ of their decision policies.

In **Part 2** subjects engage in a second set of opportunity assessment tasks, different from the conjoint task performed in Part 1 in several, important regards: first, all five section criteria will vary (as opposed to only three), requiring 16 profiles and one practice (as opposed to only 9 profiles in Part 1) – second, inexperienced entrepreneurs will randomly receive *either* cognitive or outcome-based feedback

before receiving the second (identical with the exception of no practice profile) conjoint task (i.e., after the first 33 profiles and before the second 32 profiles). Finally, in order to investigate cognitive adaptability, the 'simple' model of optimal performance – against which performance on the task was measured in Part 1 – is now replaced with the more complex model that was used by the sample of entrepreneurs from Study #1. This "expert" model is more complex than the simple base model because: 1) it has more criteria to consider, 2) feedback suggests that these criteria should be weighted 'differently' from Part 1, and 3) that the impact of three of the criteria on the assessment depends on the level of a fourth criterion (three two-way interactions).

The results of this study are presented below in two sections: first the findings from Part 1 of Study 3, followed by the findings from Part 2 of Study 3.

Part 1 of Study 3

Analysis of Individual Decision Policies for Part 1 of Study 3

87% of the individual decision policies are statistically significant ($p < 0.05$) in the first set of responses (prior to feedback), with a mean R^2 of 0.80. 91% of the individual responses were statistically significant ($p < 0.05$) in the second set of responses (post-feedback), with a mean R^2 of 0.87. These findings are consistent with previous research (Shepherd (1999) - 75% of the individual models significant with mean R^2 of .78; Choi et al, (2004) - 95% of the individual models significant with a mean R^2 of .72), and demonstrate that, on average, the variables in the model explain a significant amount of the variance in opportunity assessments.

Pearson R correlations were computed between each participant's evaluation of both the original and replicated profiles to assess the reliability of individual responses at both the *pre* (first set of responses) and *post* (second set of responses) feedback stages of the experiment. 91.2 % of the individuals demonstrate significant reliability in their first set of responses ($p < .01$) with a mean test-retest correlation of 0.72. 93% of the individuals are significantly reliable in their second set of responses ($p < .01$), with a mean test-retest correlation of 0.73. Again, this is consistent with previous conjoint studies (Choi and Shepherd (2004), which found 96% of individuals with significantly reliable responses and a mean test retest correlation of 0.82; Shepherd (1999), which found 92% of individuals with significantly reliable responses and a mean test retest correlation of 0.69). This high degree of judgmental consistency provides assurance that the conjoint task was performed consistently by the sample.

Regression analysis was used on both the first and second set of responses for each individual to produce standardized regression coefficients for the assessment criteria (Value, Rarity, and Imitability). These coefficients were used to calculate the dependent variable (Average change accuracy) for each individual in the sample (see Chapter 4 for a full discussion of these calculations). Appendix H offers a table that details the decision policies for each individual and their average change accuracy score. An example of the statistics reported in Appendix H for each individual in the sample is depicted at Figure 5.6.

Figure 5.6. Example of Statistics Reported at Appendix H.

1	2	3	4	5	6	7	8	9	10	11
Person	β Value	t -statistic	β Rarity	t -statistic	β Imitability	t -statistic	R^2	F-Statistic	Reliability	Avg. Accuracy
1	0.573	9.000	0.573	9.000	-0.573	-9.000	0.984	81.000	0.978	10.23

From left to right, column one of this table indicates individual (in this example, person #1), and columns two through seven report - for person #1 - the standardized coefficient and relevant t-statistic for each of the assessment criteria employed in Part 1 of Study 3 (Value, Rarity, and Imitability). Columns eight and nine report the R^2 and F-statistic for person #1, and column ten reports person #1's reliability. Column eleven reports the average change accuracy score for person number one. As there were, in essence, two conjoint studies representative of Part 1 of Study 3 (pre and post-feedback), Appendix x contains two tables as described above identified as 'Conjoint 1' (pre-feedback) and 'Conjoint 2' (post-feedback). Average change accuracy was calculated consistent with the methods discussed in Chapter 4, and because average change accuracy represents essentially the normative change in decision policy *between* the two conjoint studies, the score is reported one time for each individual.

Means and Correlations for Part 1 of Study 3

Table 5.2 present the means and standard deviations for the independent variable, the control variables, and the dependent variable within the inter-correlation matrix. There are significant, pair-wise correlations within and between the set of independent and control variables suggesting the possibility of multicollinearity confounding the results. Subsequent analysis employing the Variance Inflation Factor (VIF) indicated that - because all VIF scores were less than '2' - multicollinearity is not a serious problem (Neter, Wasserman, and Kutner, 1990). Distribution of responses for both control variables tested normal based on the

Kolmogorov-Smirnov test for normality ($p < .05$). Distribution of Metacognitive

Awareness also was normal ($p < .05$).

Table 5.2. Means, Standard Deviations, and Correlations

Variable	Mean	Stand. Dev.	1	2	3	4	5	6
1. Metacognition	274.33	46.86	1					
2. Age	20.44	1.58	-.279**	1				
3. Gender	55% male	0.50	.055	-.018	1			
4. Academic Major	87% business ^a	0.37	.040	.047	.072	1		
5. Regulatory Focus	35.25	6.88	.086	.039	.053	.038	1	
6. Need for Cognition	36.10	5.01	.295**	-.035	.078	.095	.118	1
7. Average Accuracy	7.68	13.48	.439**	-.010	.095	-.023	.161*	.201**

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

^a Remaining 13% represent psychology, economics, and undeclared majors.

$n = 217$

As this was the first administration of the metacognitive awareness measure developed in Study 1 of this dissertation, Figure 5.3 reports additional descriptive statistics for this measure. The measure consisted of 36-items, scored on a 1 to 11 scale such that (accounting for items reverse coded) the maximum possible score is 396, while the minimum possible is 36. As reported earlier, analysis of the distribution indicated that the data represented a normal distribution, with a mean of 274.33, and a standard deviation of 46.86. To explore variance in the measure, I conducted a one-sample *t*-test to investigate whether the means of the upper and lower quartile were significantly different from the mean of the distribution (Reis and Judd, 2000). This test was significant (*upper quartile*: $t = 2.94$, $p < .005$; *lower quartile*: $t = 3.01$, $p < .05$), suggesting adequate variance in the measure for the purposes of this study.

Table 5.3. Metacognition descriptive statistics

Variable	Statistic	Statistic
Metacognition	Mean	274.33
	95% CI Lower Bound	268.06
	Upper Bound	280.60
	5% Trimmed Mean	274.74
	Median	281.00
	Std. Deviation	46.86
	Minimum	176.00
	Maximum	369.00
	Range	193.00
	Interquartile Range	84.50

Hierarchical Regression Results for Part 1 of Study 3

Table 5.4 presents the hierarchical regression results. Results are reported for a base model (Step 1) and a full model (Step 2). The base model includes only a set of control variables, specifically age, gender, academic major, regulatory focus, and need for cognition. The full model includes the set of control variables, and the independent variable metacognitive awareness. Consistent with the discussion of hierarchical regression analysis in Chapter 4, this approach facilitates an investigation of the amount of variance in average change accuracy accounted for by metacognitive awareness 'over and above' the group of control variables included in the base model. The results for each model are reported in three columns, the first details the regression coefficients (standardized), the second the associated standard error, and the third column the t-ratio and level of significance (indicated by the number of asterisks following the t-ratio).

Table 5.4. Regression Results – Part 1 of Study 3

	<i>Base Model (Step 1)</i>			<i>Full Model (Step 2)</i>		
	Beta	St. Error	t-ratio	Beta	Std. Error	t-ratio
Age	-.095	.566	-1.42	.017	.545	.271
Gender	.076	1.800	1.13	.065	1.660	1.067
Academic Major	-.047	2.411	-.701	-.056	2.223	-.913
Regulatory Focus	.142	.130	2.12**	.116	.120	1.883
Need for Cognition	.180	.180	2.67**	.066	.173	1.029
Metacognition				.412	.019	6.183***
R ²	.077**			.219***		
Adj. R ²	.055**			.196***		
ΔR^2	.077**			.142***		

Note: Standardized regression coefficients are displayed in the Table.

** = $p < 0.05$; *** = $p < 0.01$.

$n = 217$

Age, gender (dummy-coded variable), academic major (dummy-coded variable), regulatory focus, and need for cognition were controlled for in the base model (Step 1) of the hierarchical regression analysis. These variables represented potential confounds for the reasons detailed in Chapter 4 of this dissertation.

Metacognition accounts for the increased explanatory power (standardized coefficient = .412, $p < .001$) of the full model at Step 2. The full model explains a significant amount of variance ($R^2 = .219$, $p < .001$). Further, the full model represents a significant improvement in explained variance of average change accuracy over and above base model ($\Delta R^2 = .172$, $p < .001$). The positive, standardized coefficient for metacognition indicates that - all else equal - as metacognition increases, average change accuracy improves.

Effect size - as to the implications of metacognition on the dependent variable - can be calculated using the un-standardized coefficients generated by the regression. Specifically, based on the full model - holding all variables at their mean values except for the dichotomous variables representative of academic major (set for business majors (coded +1) given that 87% of the sample were business majors) and for gender (set as male (coded +1) given that 55% of the sample was male) - the

resultant value for average change accuracy was 10.75 (no substantial difference when the model was applied for another academic major or for females, coded 0). While not very informative by itself, this score becomes interesting when its impact on average change accuracy is compared to the average change accuracy at one-standard deviation above that mean metacognitive awareness score (1 std. dev. = 46.86). At one-standard deviation above the mean metacognitive awareness score – holding all other variables at their mean values - average change accuracy increases by 46.53%. While no specific hypotheses were proposed relative to metacognition and accuracy in Part 1 of Study 3, the finding that metacognition was significant here suggests a predictive validation of the metacognition measure developed in Study #2.

Part 2 of Study 3

Analysis of Individual Decision Policies for Part 2 of Study 3

In Part 2 of Study 3, 91% of the individual decision policies are statistically significant ($p < 0.05$) in the first set of responses (prior to feedback), with a mean R^2 of 0.67. 89% of the individual responses were statistically significant ($p < 0.05$) in the second set of responses (post-feedback), with a mean R^2 of 0.76. Again, these findings are consistent with previous research (Shepherd (1999) - 75% significant of the individual models significant with mean R^2 of 0.78; Choi et al, (2004) - 95% significant of the individual models significant with a mean R^2 of 0.72), and demonstrate that, on average, the variables in the model explain a significant amount of the variance in opportunity assessments

Pearson R correlations computed between each participant's evaluation of both the original and replicated profiles assess the reliability of the responses in both

the *pre* and *post* feedback stages of the experiment. 88 % of the individuals are significantly reliable in their first set of responses ($p < .01$) with a mean test-retest correlation of .72. 94% of the individuals are significantly reliable in their second set of responses ($p < .01$) with a mean test-retest correlation of .81. Again, this is consistent with previous conjoint studies (Choi and Shepherd (2004), which found 96% of individuals with significantly reliable responses and a mean test retest correlation of .82; Shepherd (1999), which found 92% of individuals with significantly reliable responses and a mean test retest correlation of .69). This high degree of judgmental consistency provides assurance that the conjoint task was performed consistently by the sample.

Regression analysis was used on both the first and second set of responses from each individual to produce two decision policies - - pre-feedback and post-feedback - - each represented by standardized regression coefficients for the five (as opposed to three criteria utilized in Part 1 of Study 3) assessment criteria (Value, Rarity, Imitability, Limits of Competition, and Relatedness) and for the three significant interactions (from study 1 and contained in the expert model). These coefficients were used to calculate the dependent variable (Average change accuracy) for each individual in the sample (see Chapter 4 for a full discussion of these calculations).

Like *Appendix H* provided to detail individual decision policies in Part 1 of this study, *Appendix I* offers a table that details the two decision policies for each individual for Part 2 of this study and an average change accuracy score. In Part 2, the number of assessment criteria has increased from three with no interactions (in

Part 1) to five criteria with three interactions (in Part 2). Thus, the Appendix detailing the individual decision policies of the sample for Part 2 differs from the one included in Part 1 only in the number of standardized coefficients and associated t-statistics reported (in addition, standardized coefficients and associated t-statistics are reported for the interactions between relatedness and the RBV derived criteria). As there were, in essence, two conjoint studies representative of Part 2 of Study 3 (pre and post-feedback), *Appendix I* contains two tables as described above identified as 'Conjoint 3' (pre-feedback) and 'Conjoint 4' (post-feedback).

Means and Correlations for Part 2 of Study 3

Table 5.5 presents the means and standard deviations for the independent variable, the control variables, and the dependent variable within the corresponding inter-correlation matrix. There are significant, pair-wise correlations within and between the set of independent and control variables suggesting the possibility of multicollinearity confounding the results. The implications of suspected multicollinearity for the hierarchical regression analysis are discussed in detail at the conclusion of the results section. Significant correlations indicate that both metacognition and feedback type are related to average change accuracy in the expected direction. To evaluate whether or not these relationships remain significant – over and above the set of control variables and each other – hierarchical regression analysis was performed.

Figure 5.5. Means, Standard Deviations, and Correlations

Variable	Mean	Stand. Dev.	1	2	3	4	5	6	7	8
1. Metacognition	274.33	46.86	1							
2. Age	20.44	1.58	-.279**	1						
3. Gender	55% male	n/a	.057	-.018	1					
4. Academic Major	87% business*	0.37	.040	.046	.072	1				
5. Regulatory Focus	35.25	6.88	.085	.040	.053	.038	1			
6. Need for Cognition	36.10	5.01	.294**	-.035	.077	.095	.118	1		
7. Feedback Condition	.5, -.5	n/a	.031	.029	-.007	-.002	.020	.019	1	
8. Metacognition * Feedback	-7.50	139.26	.026	.008	.008	-.005	.027	.024	.990**	1
9. Average Accuracy	7.68	13.48	.188**	-.118	.055	.026	-.037	.143*	.332**	.369**

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

* Remaining 13% represent psychology, economics, and undeclared majors.

n=217

Further, for exploratory purposes additional correlations were performed to assess the extent that Average Change Accuracy scores from Part 1 of Study 3 were related to Average Change Accuracy scores from Part 2 of Study 3. This analysis revealed a significant correlation (.435, $p < .001$), suggesting that those individuals accurately adjusting their decision policies in Part 1 (given feedback) were also most able to successfully adjust their decision policies in Part 2 (given feedback).

Results for Part 2 of Study 3

Table 5.6 presents the hierarchical regression results. Results are reported for a base model (Step 1), a main effects model (Step2), and a full model (Step 3). The base model includes only a set of control variables, specifically age, gender, academic major, regulatory focus, and need for cognition. The main effects model includes the set of control variables, and the independent variables metacognitive awareness and feedback condition (coded .5 for cognitive feedback and -.5 for outcome feedback). The full model includes the set of control variables, the independent variables metacognitive awareness and feedback condition (coded .5 for cognitive feedback and -.5 for outcome feedback), and the interaction between metacognition and feedback type. Consistent with the discussion of hierarchical regression analysis in

Chapter 4, this approach facilitates an investigation of the amount of variance in average change accuracy accounted for by the inclusion of additional explanatory variables in both Step 2 and Step 3, 'over and above' the group of variables included in previous regression model. The results for each model are reported in three columns: the first details the regression coefficients (standardized), the second the associated standard error, and the third column the t-ratio and level of significance (indicated by the number of asterisks following the t-ratio).

Table 5.6. Regression Results – Part 2 of Study 3

	<i>Base Model (Step 1)</i>			<i>Main Effects Model (Step 2)</i>			<i>Full Model (Step 3)</i>		
	Beta	Std. Error	t-ratio	Beta	Std. Error	t-ratio	Beta	Std. Error	t-ratio
Age	-.071	.109	-1.260	-.048	.112	-.817	-.040	.109	-.365
Gender	.044	.344	.772	.042	.339	.754	.144	.376	.436
Academic Major	.014	.461	.243	.012	.454	.216	.017	.441	.307
Regulatory Focus	-.021	.025	-.372	-.034	.025	-.606	-.045	.024	-.814
Need for Cognition	.129	.034	2.259***	.096	.035	1.636	.088	.034	1.546
Gap 1 - Start Pt.	-.611	.063	-9.676***	-.547	.068	-7.987***	-.524	.067	-7.845***
Metacognition				.007	.004	1.909*	.009	.004	2.254**
Feedback Condition				.776	.369	2.101**	6.342	1.970	3.220***
Feedback Condition * Metacognition							.026	.007	3.676***
R ²	.335***			.360***			.399***		
Adj. R ²	.316***			.336***			.373***		
ΔR^2	.335***			.025***			.039***		

Note: Unstandardized regression coefficients are displayed in the Table.

* = $p < 0.10$; ** = $p < 0.05$; *** = $p < 0.01$.

$n = 217$

Age, gender (dummy-coded variable), academic major (dummy-coded variable), regulatory focus, and need for cognition were controlled for in the base model (Step 1) of the hierarchical regression analysis. These variables represented potential confounds for the reasons detailed in Chapter 4 of this dissertation. The base model, consisting of control variables only, is inadequate to explain a significant amount of the variance in average change accuracy ($R^2 = .038$, $p > .10$).

The main effects model (Step 2) explains a significant amount of variance ($R^2 = .164$, $p < .001$) in average change accuracy. Further, the main effects model represents a significant improvement in explained variance of average change accuracy over and above base model ($\Delta R^2 = .126$, $p < .001$). Both metacognition and

feedback type account for this increased explanatory power. Specifically, metacognition is significant and positively related to average change accuracy (standardized coefficient = .128, $p < .005$) such that - all else equal - as metacognition increases, average change accuracy improves. Feedback type is also significant and related to average change accuracy (standardized coefficient = .331, $p < .001$) such that average change accuracy improves as one moves from the outcome feedback condition (coded 0) to the cognitive feedback condition (coded +1).

The full model (Step 3) explains a significant amount of variance ($R^2 = .221$, $p < .001$) in average change accuracy. Further, the full model represents a significant improvement in explained variance of average change accuracy over and above the main effects model ($\Delta R^2 = .057$, $p < .001$). Metacognition, feedback type, and the interaction between metacognition and feedback type are significant in the full model and thus the interaction between metacognition and feedback type accounts for the increased explanatory power of the full model over the main effects model. Specifically, metacognition is significant and positively related to average change accuracy (standardized coefficient = .148, $p < .005$) such that - all else equal - as metacognition increases, average change accuracy improves. This finding provides support for Hypothesis 6. Feedback type is also significant and positively related to average change accuracy (standardized coefficient = 1.019, $p < .005$) such that average change accuracy improves as one moves from the outcome feedback condition (coded 0) to the cognitive feedback condition (coded +1). This finding provides support for Hypothesis 7. Further, the interaction between metacognition and feedback type is significant (standardized coefficient = 1.44, $p < .005$) and positive as related to average

change accuracy. To better understand the nature of this interaction between metacognition and feedback type, it is plotted at Figure 5.7 below consistent with the techniques recommended by Cohen and Cohen (1983). The dependent variable – average change accuracy – is plotted on the Y-axis. Feedback condition is plotted on the X-axis such that moving from left to right along the X-axis represents moving from the outcome to feedback condition. Employing regression coefficients to calculate values of average change accuracy, the plots represent values of average change accuracy at both one-standard deviation above and below the mean value for metacognition – in each of the feedback conditions (outcome – cognitive).

Figure 5.7. Interaction Plot - Feedback Condition by Metacognition on Average Change Accuracy – Part 2 of Study 3

Contingent Relationship between Metacognition and Feedback Type for Opportunity Evaluation Policies
Average Accuracy

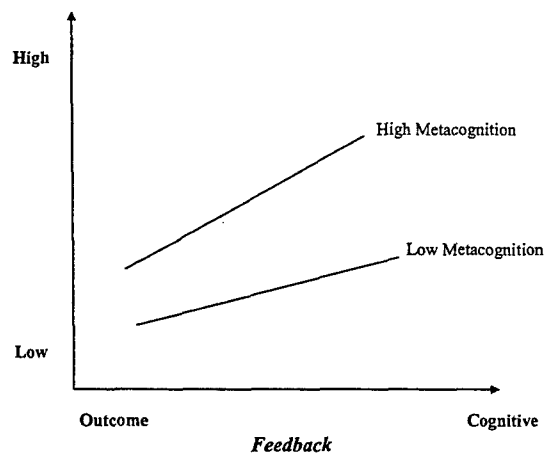


Figure 5.7 indicates that moving from outcome to cognitive feedback (left to right) improves average change accuracy. Further, the demonstrated improvement in average change accuracy is more positive for those individuals high on metacognition than those low on metacognition (depicted by the significant and positive change in slope between low and high metacognition). Again, the nature of this interaction

suggests that the positive relationship between cognitive (over outcome) feedback and cognitive adaptability is more positive for those individuals with higher metacognitive awareness than those with less metacognitive awareness. The nature of this significant interaction provides support for Hypothesis 8.

While no specific hypotheses were developed related to the relationship between feedback and low levels of metacognition, the findings of this study highlight an interesting, exploratory question: does cognitive feedback improve average accuracy movement for those low in metacognition (is the line representative of low metacognition significantly different from zero)? To investigate this question a series of additional tests were performed. Specifically, individuals were divided into quartiles based on metacognition (quartile # 1 being the lowest on metacognition, and quartile # 4 being the highest on metacognition) and a series of correlations were performed relating average change accuracy to feedback condition. In the bottom quartile of the sample (based on metacognition), there was no significant correlation between feedback condition and average change accuracy ($p > .05$). This finding suggests that for those lowest on metacognitive awareness, cognitive feedback (over outcome feedback) was not related to an improvement in decision accuracy. A similar analysis was performed for those individuals in the second quartile (based on metacognition), and in this case the correlation between average change accuracy and feedback condition was significant at ($p < .10$), indicating that feedback condition was marginally related to average change accuracy for this group.

A summary of the findings reported in Study 3 as related to the hypothesized relationship detailed in Chapter 3 is presented at Figure 5.8 below:

Figure 5.8. Summary of Results – Study 3

Hypotheses	Support
H6: Individuals with greater metacognitive awareness have greater cognitive adaptability at entrepreneurial tasks than those with less metacognitive awareness.	Supported
H7: Individuals given cognitive feedback on their decisions at an entrepreneurial task have greater cognitive adaptability than those given outcome-based feedback.	Supported
H8: The positive relationship between cognitive (over outcome) feedback and cognitive adaptability is more positive for those individuals with higher metacognitive awareness than those with less metacognitive awareness.	Supported

A note of the effects of multicollinearity in this study

As detailed above, the interaction between metacognition and feedback type is significant (standardized coefficient = 1.44, $p < .005$) and positive as related to average change accuracy. However, as foreshadowed by the inter-correlation matrix presented at Table 5.x, an analysis of the Variance Inflation Factors (VIF) suggests multicollinearity in the data – specifically between the interaction term and feedback type ($VIF > 10$). Multicollinearity describes a problem where it becomes difficult to separate the effects of two or more explanatory variables on an outcome variable – in this case average change accuracy. If the explanatory variables are highly correlated (highly ‘alike’) then it becomes impossible to determine which of those explanatory variables accounts for the variance in the dependent variable. The more multicollinearity in the model, the larger the variances of parameter estimates which means that the estimates of the parameters will tend to be less precise. Further, as a result of multicollinearity the model will tend to demonstrate insignificant tests and wide confidence intervals. However, in the case of this study the concerns cited above – specifically related to the interpretation of the parameter estimate for the interaction terms - are unwarranted for the following reasons.

First, consistent with Fox and Monette (1992), I suggest that the multicollinearity exhibited here is an artifact of the experimental design and coding

scheme (.5 and -.5 for feedback condition), and therefore not relevant to analysis or interpretation of the interaction term. Fox and Monette empirically demonstrate that - based on how the VIF is calculated - the measure is not applicable to categorical regressors (such as feedback in this study) because such regressors do not represent the effects of *different* explanatory variables, and therefore the authors describe any collinearity that results as 'artificial.' Specifically, in the case of the interaction between a continuous variable (metacognition) and a categorical variable (feedback, the VIF represents the impact of collinearity on the joint confidence region for the two variables, however because the categorical variable is not normally distributed (either feedback condition) the VIF becomes artificially inflated. Instead, the authors recommend adjusting the VIF to represent the 'squared size of the confidence region between the two variables' which is analogous to taking the square root of the VIF representative of the interaction term (Fox & Monette, 1992). When applying this adjustment to the VIF demonstrated between feedback and the interaction between feedback and metacognition in this study (VIF=35.62), the adjusted VIF becomes 5.96 and is below the threshold of concern.

Second, multicollinearity does not violate any of the assumptions of OLS regression. The OLS parameter estimates given multicollinearity are still B.L.U.E. (Best Linear Unbiased Estimator), however the variance of the parameter estimates are inflated making it more difficult to realize significant results. In the case of this study, the interaction between metacognition and feedback was significant *in spite* of the demonstrated multicollinearity. Thus because the parameter estimates remain

unbiased in the face of multicollinearity, the significant relationships demonstrated in this study are statistically valid.

In Chapter 6, I will discuss the implications and contributions of this body of research to the domains of both entrepreneurship and social psychology research.

CHAPTER 6

DISCUSSION AND CONCLUSION

Overview

This chapter is devoted to a review, discussion, and integration of the theoretical and empirical implications of this dissertation.

First, I will begin by re-visiting the theoretical foundations of this dissertation – situated metacognition - in the context of the general focus of this research – cognitive adaptability. Next, I will discuss the results of the three studies representative of my efforts to investigate cognitive adaptability in the context of an entrepreneurial task. In doing so I will highlight the theoretical and empirical contributions of each of these studies to the entrepreneurship literature specifically, suggesting avenues for future research given the findings of this dissertation. In a similar vein, I will also discuss the contributions of this research to the social psychology and metacognition literatures. I will then move to address the limitations of this research, highlighting generally the limitations associated with experimental studies. Finally, I offer some concluding comments.

Cognitive Adaptability, Metacognition, and Entrepreneurship – Theoretical Contribution

The model of *socially situated metacognition* developed in Chapter Two represents one of the major contributions of this dissertation. Through this model I bring together previously disparate literatures from social psychology and metacognition in a framework of socially situated metacognition focused on the role of ‘higher-order’ strategies promoting cognitive adaptability in a dynamic context. This theoretical framework represents an important step towards realizing the stated

goal of many entrepreneurship scholars, that is 'opening the back box' of entrepreneurial cognition to more fully understand the relationship between cognition and performance in an entrepreneurial environment.

Situated metacognition provides a compelling lens to study entrepreneurship for a number of reasons. First, the role of cognitive functioning can be examined over the duration of the entrepreneurial process. Metacognition enables us to study the dynamics of making sense of the economic and social environment embedded in a context that begins prior to the identification of the entrepreneurial opportunity, and runs through the many stages and steps associated with exploiting entrepreneurial opportunities. Metacognitive research is consistent with scholars' interest in how context influences what cognitive strategies are developed and/or identified. Further, metacognition is naturally suited to studying individuals engaged in a series of entrepreneurial processes and examining cognitive processes across entrepreneurial endeavors. In addition, as the findings of Study 3 suggest, metacognitive processes may be important in dynamic environments. When environmental cues change, individuals adapt their cognitive responses and develop strategies for responding to the environment (Earley, Connolly, & Ekegren, 1989a). Given the dynamism and uncertainty of entrepreneurial contexts, metacognition facilitates studying how entrepreneurs cognitively adapt to their evolving and unfolding context. Finally, research on metacognition and cognitive strategies is closely aligned with work on motivation (Bandura, 1996; Earley et al., 1989a; Earley, Connolly, & Lee, 1989b; Kanfer & Ackerman, 1989; Wood & Bandura, 1989), a construct associated with entrepreneurial behavior (Baum, Locke, & Smith, 2001; Shaver & Scott, 1991;

Wiklund, Davidsson & Delmar, 2003). Shane, Locke, and Collins write that “human motivations influence [entrepreneurial] decisions, and [that] variance across people in these motivations will influence who pursues entrepreneurial opportunities, who assembles resources, and how people undertake the entrepreneurial process” (2003: 257). The model of situated metacognition proposed in this dissertation developed the proposition that individual motivations influence the display of metacognition given the social context. A metacognitive lens that incorporates the influences of individual motivation and social context will enhance our ability to understand, explain, and ultimately predict entrepreneurial behaviors and outcomes.

As a way to classify the many implications of the model detailed above as contributions relative to the extant entrepreneurship literature, I suggest that my theoretical contribution is generally twofold. First, the model suggests a framework through which we can investigate the influences of idiosyncratic goals, motivations, and environmental context on cognitive processing. The model proposed here suggests that differences between entrepreneurs in terms of sense-making and subsequent behavior may not necessarily be the result of inherent differences in entrepreneurs in cognitive ability or process, but to an idiosyncratic interpretation of the conjoint influences of motivation and context which, in turn, may result in disparate cognitive strategies employed to realize some outcome. This relationship is under-studied in the entrepreneurship literature as highlighted by the literature review presented in Chapter 2.

Second, this model is representative of a framework through which to consider the cognitive mechanisms that promote adaptable thinking in a dynamic

environment - rather than the extant focus on the role that cognitive processes play in inhibiting such adaptability – by introducing to the literature a set of constructs (metacognitive knowledge, metacognitive experience, metacognitive control, and monitoring) focused on the process through which cognitive strategies are developed and employed to realize some entrepreneurial end. Given this general classification of my theoretical contribution, I will now move to explore specific examples of how the model may serve to address understudied areas in the extant entrepreneurship literature that are fundamental to the study of entrepreneurial activities; specifically demonstrating how my theoretical contributions serve to integrate previously disparate research streams, interpret previous research, and influence the direction of future efforts.

First consider the distinctions between knowledge and metacognitive knowledge, and between experience and metacognitive experience. I propose that these distinctions provide the basis for relating my metacognitive model to previous research on entrepreneurial cognition. Beyond specialized knowledge, metacognitive knowledge allows us to explain individual differences in the way that entrepreneurs organize what they know about people, tasks, and strategies. Individuals with the same specialized knowledge (and motivation and context) may have different schema to organize that knowledge. They could employ significantly different cognitive strategies and achieve different entrepreneurial outcomes. Entrepreneurial outcomes might vary because of different abilities to access specialized knowledge and combine schemas to formulate cognitive strategy.

In addition to metacognitive knowledge, my model highlights the importance of metacognitive experience. Metacognitive experience involves intuition and feelings. Conner highlights the importance of intuition when she writes that "In a resource-based view, discerning appropriate inputs is ultimately a matter of entrepreneurial vision and intuition, the creative act underlying such visions is a subject that so far has not been a central focus of resource-based theory development" (1991: 121). My metacognitive model highlights the importance of intuition as part of the metacognitive process, and how heterogeneity in intuition may explain differences among individuals in the selection of cognitive strategies and entrepreneurial outcomes. Taken together, exploring how metacognitive knowledge and metacognitive experience are combined to formulate metacognitive strategy offers a potential explanation for why certain individuals choose certain cognitive strategies, and others - placed in a similar context and with similar knowledge - will adopt different strategies. Metacognitive selection of one cognitive strategy over another involves two constructs that have, until now, been relatively ignored in the entrepreneurship literature. Understanding metacognitive knowledge and metacognitive experience helps to open up the "black box" of the entrepreneurial cognition literature - it not only offers an explanation for why people differ in their cognitive strategies, but also why an individual may use different cognitive strategies when facing different contexts and different motivational states and after experiencing different types of feedback. The entrepreneurship literature has not yet incorporated these ideas.

As another example consider the extant work on relating heuristics and entrepreneurial behaviors, which is generally focused on differences *between* individuals (Baron, 1998; Alvarez & Busenitz, 2001). My metacognitive approach also allows for a focus that explains differences within individuals across situations. Why does an entrepreneur's use of cognitive strategies differ over time? My metacognitive perspective points to four possible explanations: 1) given a constant motivational state, a change in the task could represent a change in contextual factors triggering an individual's metacognitive process and thus, the potential for a different cognitive strategy to be used, 2) given a constant context, a change in one or more of an individual's motivational factors could trigger the metacognitive process and produce a different cognitive response, 3) the outcome of a previous cognitive response could provide performance feedback that stimulates a change in motivational and/or contextual factors, which then triggers changes detailed in the previous two points, and 4) the outcome of a previous cognitive response provides feedback information for metacognitive monitoring and change metacognitive knowledge and/or metacognitive experience, which leads to the selection of a different cognitive strategy. By accommodating intra-individual differences in cognition strategies and subsequent entrepreneurial outcomes, a metacognitive perspective allows for richer explanations, such as why people move in and out of entrepreneurship throughout their life-course.

Further, existing research on heuristics has increased our understanding of information processing (especially cognitive load and speed) and decision errors (Garcia-Marques, Hamilton, & Maddox, 2002). With regard to entrepreneurship,

this work has highlighted the decision errors entrepreneurs may commit due, in part, to their extreme environmental conditions and perceptions of risk (Busenitz, 1999). An investigation of the types of cognitive strategies available to an individual could extend the entrepreneurial heuristic research. In a sense, metacognition serves as a psychological mechanism that bridges the divide between the biases embedded in individuals' cognitive mechanisms and a state of cognitive adaptability that facilitates functioning in a dynamic environment. Metacognition can help individuals compensate for limitations to decision making brought on by heuristics and biases in decision making. This compensating effect of metacognition may be especially prominent because the ability to access different cognitive strategies is particularly valuable in the dynamic and challenging entrepreneurial context.

As another example of how situated metacognition may extend the extant entrepreneurship literature, consider Sarasvathy's influential work on effectuation. Sarasvathy seeks to "identify and develop a decision model that involves processes of effectuation, rather than causation, and showing its use in the creation of new firms....Causation processes take a particular effect as given and focus on selecting among possible means to create that effect. Effectuation processes take a set of means as given and focus on selecting among possible effects that can be created with that set of means" (2001: 244-245). The selection of causal versus effectual reasoning may depend, in part, on the extent to which an individual employs metacognitive processes.

Although Sarasvathy's goal is not explaining why effectuation is used instead of a causal cognitive strategy, my situated metacognitive model speaks to this with a

parallel approach. Sarasvathy emphasizes an individual's perception of his/her environment along with motivational factors such as "the desire to make lots of money or to create a valuable legacy like a lasting institution, or, more common, to simply pursue an interesting idea that seems worth pursuing" (2001: 244). A dynamic, linear, and independent environment or context may influence the usefulness of causal or effectual cognitive strategies (2001: 251).

A central element of both causal and effectual cognitive strategies is the set of "means" available to the entrepreneur and how those means are employed.

Sarasvathy writes that "entrepreneurs begin with three types of means: they know who they are, what they know, and whom they know" (2001: 250). My model of situated metacognition suggests that these 'means' are organized and acted upon based on metacognitive knowledge and metacognitive experience. Take, for example, the means "whom they know." One cognitive strategy may be to use one's network to identify potential new venture opportunities. A metacognitive strategy, however, could expand one's network, reshape its structure, etc. as a new way of identifying opportunities. An entrepreneur might use a metacognitive approach to bring together individuals in his or her networks that are otherwise unconnected, so that the synergy of bringing them together yields ideas for new business opportunities. Awareness of these 'means' facilitates the selection of a cognitive strategy, effectual or causal. Thus, differences in metacognitive awareness explain (a) why some entrepreneurs use effectual reasoning and others use causal reasoning and (b) why some entrepreneurs change their cognitive response (i.e., from causal to

effectual and vice versa) to accommodate a changed environment or motivation and others do not change their cognitive response.

As a final example of the contribution that the model of situated metacognition makes toward extending or re-interpreting the extant entrepreneurship literature, consider Baron's work on counterfactual thinking in light of the metacognitive model.

Baron investigates one specific cognitive mechanism – counterfactual thinking - which involves “reflecting on outcomes and events that might have occurred if the person in question had acted differently or if circumstances had somehow been different” (2000: 79). Baron finds that entrepreneurs are less likely than the other groups to engage in counterfactual thinking, experienced less regret over past events than potential entrepreneurs, and found it easier to admit past mistakes both to themselves and to others. Baron (2000: 80) states that the implications of these findings for entrepreneurship are that:

“... engaging in counterfactual thinking often generates negative affective states (e.g., feelings of regret, dissatisfaction, envy). Such negative affective states, in turn, can strongly color perceptions and judgments, causing individuals to perceive situations in less favorable terms (e.g., as riskier, less promising) than would otherwise be the case. Entrepreneurs' relatively low tendency to engage in counterfactual thinking may minimize such reactions and so contribute to their decisions to start new ventures.”

These implications highlight an important research question: how do negative affect states, which arise from reflecting on past events, impact entrepreneurial outcomes such as the decision to start new ventures? The metacognitive model suggests that a possible explanation is provided by the feedback loops of performance monitoring and metacognitive monitoring. I propose that negative affect states are perceived in

light of some 'goal state.' Any discontinuity that exists between the current state and the goal state compel an individual to either re-evaluate his entrepreneurial goals (performance monitoring), or re-evaluate his or her metacognitive strategy (metacognitive monitoring) for making sense of the entrepreneurial environment. This process results in cognitive adaptability, which contributes to minimizing the negative affect and thus furthers entrepreneurial outcomes. Thus, counterfactual thinking may only impact entrepreneurial outcomes to the extent that it changes the entrepreneur's (a) perception of the environment, (b) motivation, (c) metacognitive awareness, (d) metacognitive knowledge, and/or (e) metacognitive experience.

Situated Metacognition – A Contribution Cognitive Psychology

While the focus of this dissertation has been entrepreneurship, given the calls of many prominent scholars to bridge the divide that currently exists between social cognition and metacognition (see special issue of *Personality and Social Psychology Review* (1998) devoted to this issue), the model of situated metacognition also represents a theoretical contribution to those literatures.

Walter Mischel describes the evolution of metacognition as research at the "hyphen" of cognitive and social psychology, and develops this premise in the context of the contributions made by Schachter and Tversky to their respective disciplines. Mischel writes that the work of Schachter and Tversky "addressed two questions in one breath: first, the mechanisms and constraints of the mind as people deal with problems that require thinking, judgment, and remembering; and second, how the problem solver tries to make sense of what is happening within the situation under uncertain conditions that characteristically prevail in life – and that clever

experiments capture for a moment” (Mischel, 1998: 84). Mischel notes both Schachter and Tversky “forged a bridge” between cognitive and social psychology, opening the door to explore jointly how people think, and how people interpret a situation based on their own motivations.

Further, exploring metacognition in the spirit of a mechanism to bridge cognitive and social psychology, Jost, Kruglanski, and Nelson write that the “contents and origins of metacognition are inherently social; at the same time, metacognitions are comprised of cognitive elements and are governed by the principles and laws applicable to human thinking in general (1998: 137).” Allen and Armour-Thomas (1993: 204) note that cognitive processes “emerge, develop, and are displayed within a socio-cultural milieu... [and that] contextual forces serve a socializing function in shaping the development and deployment of mental processes in ways that facilitate or constrain task performance.” It is “meaningless to ask a question about any type of thinking without asking concomitant questions about contextual forces in which such thinking is situated” (Allen & Armour-Thomas, 1993: 204).

The model of socially situated metacognition developed in this dissertation is consistent with the theoretical integration described above. The model focuses on the joint roles of individual motivation and social context, on the metacognitive processes employed in the selection and regulation of cognitive strategies. While only a first step, I suggest that the introduction of a robust, testable model that serves to incorporate the social components of metacognitive processing will further the integration of two previously disparate domains of research – metacognition and

social cognition – and therefore represents a legitimate contribution to these literatures.

In the next section I will consider the findings and contributions generated from each of the three studies representative of this dissertation.

Study 1 – An Entrepreneurial Task

Study 1 was a ‘means to an end’ in this dissertation, such that I required an expert model of opportunity evaluation to use as the basis for the feedback presented to the inexperienced entrepreneurs in Study 3. That said, I believe that this study makes important contributions to the entrepreneurship literature.

In this study I developed and tested a model of entrepreneurial opportunity evaluation grounded in the tenets of the RBV. Specifically, the RBV literature was supplemented with research on human capital and incorporated into a framework designed to investigate entrepreneurs’ evaluations of the attractiveness of opportunities. This framework enabled me to investigate *how* the heterogeneity promoting/maintaining criteria ascribed by the RBV were actually employed by entrepreneurs engaged in opportunity evaluation tasks. Further, I was also able to test how those relationships were moderated by an additional opportunity attribute conceptualized as *relatedness* – the extent to which the opportunity was related to entrepreneurs’ existing knowledge, skills, and abilities. I believe that the findings of this research offer valuable insights into 1) the role of human capital in understanding the perceived benefit of resources, 2) the contribution of Petraft’s (1993) extension to RBV, and 3) how the RBV is reflected in the decision policies of individuals faced

with a specific entrepreneurial task – opportunity evaluation. Each of these contributions is discussed below:

Relatedness of Opportunities to Entrepreneurs' Human Capital

By integrating a human capital variable into the opportunity evaluation framework, my findings complement and extend existing RBV literature by offering insight into the contingent relationship that exists between entrepreneurs' assessments of the heterogeneity promoting attributes of an opportunity, and the relatedness of the opportunity to the human capital of the individual making the evaluation. These findings suggest that all heterogeneous resources – those that are valuable, rare, and have limits on competition – are not equally attractive to entrepreneurs evaluating opportunities to realize a sustainable competitive advantage in the marketplace. Rather, the extent to which the attributes of the opportunity are positively associated with entrepreneurs' evaluations of opportunity attractiveness depend upon how related this opportunity is to their existing human capital.

This finding suggests, at least in the evaluation policies of my sample of entrepreneurs, that high relatedness may facilitate an efficient and effective integration of the resources which will result from exploitation with the existing resource endowments of the venture – the human capital of the entrepreneur; thus promoting new resource combinations in such a way that the potential economic return generated by the opportunity is not dissipated by the costs associated with integrating the resource so that it can be employed in generating rents. This interpretation is consistent with Williamson's (1985) transaction cost argument as to asset specificity, or "the degree to which an asset can be redeployed to alternatives

uses and by alternative users without sacrifice of productive value” (Williamson, 1991: 281). I suggest that while an opportunity (the resources that result from its exploitation) may be rare, valuable, inimitable/non-substitutable, and confer a highly defensible market position, it could be that the costs of integrating that opportunity – because it is highly unrelated to the knowledge, skills, and abilities of the entrepreneur - significantly mitigate its attractiveness as a candidate for exploitation. Therefore, I have provided some support for the general proposition that not only is heterogeneity of a given resource important to decision-makers, but the extent to which the opportunity is related to the existing resource endowment is significant in “new resource” acquisition decisions, in this case, the decision to exploit an opportunity. This has two potentially important implications for scholars.

First, I have provided some support for the notion that the relatedness of new resources to the existing resources and routines of well-established organizations applies to the resources of individuals, specifically, their knowledge, skills and abilities, and their opportunity evaluations. This suggests that when it comes to making decisions, resources are possessed by individuals not just organizations (at least from the decision maker’s perspective). This builds on the entrepreneurship research that has focused on entrepreneurs’ human capital (e.g., Davidsson and Honig, 2003; Gimeno, Folta, Cooper, & Woo, 1997) and links it with research that highlights the importance of the relatedness of knowledge to the discovery (Hayek, 1945; Shane, 2000; Venkataraman, 1997) and exploitation (Choi & Shepherd, 2004; Holmqvist, 2004; Shane, 2000; Rothaermal, 2001) of opportunities.

Second, it appears useful to think of opportunities as representative of the set of resources that will/could result from eventual exploitation. I speculate that one of the reasons that opportunity evaluation remains an under-studied component of the entrepreneurial process is the difficulty associated with operationalizing what appears to be an abstract construct – the opportunity. However, I assert that the logic of conceptualizing opportunities as representative of the set of resources that will/could result from eventual exploitation is both simple and promising.

Limits on Competition

I find in this study that the extent to which there were limits on competition (i.e., future market position for the opportunity was defensible) had a significant, positive influence on entrepreneurs' evaluations of opportunity attractiveness. This finding is consistent with - and provides some empirical support for - Peteraf's (1993) position that competitive strategy is a function of the managerial decisions as to how firms both *acquire* heterogeneous resources, and *employ* these idiosyncratic resources in such a way as to limit competition in order to achieve a sustainable advantage over competitors (Barney, 1991; Peteraf, 1993). Peteraf extended RBV by proposing heterogeneity of the resource, by itself, is not enough to sustain competitive advantage and that there must be forces which also serve to maintain resource heterogeneity, thus extending our understanding of resource-based competitive strategy. My findings indicate that Peteraf's proposition is represented in the opportunity evaluation policies of a sample of entrepreneurs. Although I do not offer a thorough test of Peteraf (1993) (because it was not my purpose) it does highlight the contribution and the practical relevance of this extension to the core

principles of RBV (such as those articulated by Barney [1991]). I believe that future research consistent with the methodological techniques employed in this paper can offer a more fine-grained test of exactly under what conditions and how Peteraf's contribution to the RBV is represented in the decision policies of managers.

The RBV from a Decision Making Perspective

In this study I used a decision making perspective to investigate opportunity evaluation and the RBV. This perspective is consistent with 1) what Conner termed "entrepreneurial vision and intuition" which requires further attention but has not "been a central focus of resource-based theory development" (1991: 121), 2) what Barney argued was the essence of competitive strategy, namely, the managerial decisions as to how firms acquire and employ idiosyncratic resources (1991), and 3) the content of entrepreneurs' heuristics, which Alvarez and Busenitz (2001) proposed as central to "the recognition of new opportunities and the assembling of resources for the venture" (2001: 755). The above conceptual works all imply that judgments on the part of the manager are central to resource-based strategies. By empirically investigating a resource-based approach to the evaluation of opportunities, I have provided evidence that entrepreneurs do think about the issues that the RBV suggests that they should, and further that they employ contingent decision policies in doing so.

Conclusion to Study 1

In this study I successfully model a resource-based framework for opportunity evaluation from a decision-making perspective, providing insight into how individual

heterogeneity promoting/maintaining criteria – value, rarity, inimitability, and limits on competition - are employed by the decision-maker. Thus I demonstrate that a resource-based logic can be extended and employed in the evaluation of intangible resources – specifically opportunities – and in an entrepreneurial context. I believe that my findings have important implications for future research focused on understanding opportunity evaluation, as well for scholars positioned to apply resource-based theories to entrepreneurial tasks.

Among several important contributions, I believe that the integration of RBV and human capital theories, in the context of opportunity evaluation decisions, represents an important step toward understanding how and why entrepreneurs choose to exploit some opportunities and dismiss others. I found support for the proposition based on human capital theory that the entrepreneur's evaluations of the attractiveness of given opportunities is, in part, based on the extent to which the opportunity is related to the existing knowledge, skills, and abilities – human capital - of the entrepreneur. RBV theorists acknowledge that acquired, new resources must be combined with the existing resources of the firm in order for those resources to be employed in a productive manner (Penrose, 1959). Given my findings, I speculate that the entrepreneurs in this sample framed their assessments of opportunity attractiveness based on how the resources that will result from opportunity exploitation will/could be integrated with their existing resource endowments, specifically their own human capital. This finding is important because it serves to empirically demonstrate a proposition that has been implied but under-studied in the RBV literature - that the efficiency and effectiveness in which resources may be

integrated together and employed in generating rents may be moderated by the extent to which those resources are related and complementary to existing resources – in the case of entrepreneurs, idiosyncratic human capital attributes.

Further it appears, at least to the entrepreneurs sampled here, that while an opportunity might not be rare and/or have limits to competition, it still may be attractive if it is related to their existing skills, knowledge, and abilities. These findings warrant additional consideration and speculation. Specifically, why is it that assessed opportunity attractiveness is enhanced when rarity and/or limits on competition are low?

It might be that entrepreneurs are quite pragmatic and are not looking for the perfect opportunity, but to find an imperfect opportunity that is more perfect for them than for others. That is, even though it may not be rare and competition might be high, this opportunity's relatedness to the knowledge, skills, and abilities of the entrepreneur give him or her sufficient competitive advantage that they can out hustle others' to achieve a sustainable competitive advantage through resource integration and superior exploitation. This reasoning is consistent with Sarasvathy's theory of effectual reasoning (2001) in entrepreneurship such that it is the *combination* of 'means' that represent the mechanism through which some 'end' can be realized.

Further, these finding may alternatively represent the manifestation of a closely held psychological bias – or cognitive depiction – of how the attribute value (as opposed to rarity and limits on competition) is interpreted by the entrepreneurs. It could be that the entrepreneurs conferred some significance to value - because of pre-existing representations of the connotations of a valuable resource – that were beyond

the scope of how value was employed in this study. Thus because the attribute value was held in such high regard by the entrepreneurs they perceived it to be somehow 'different' from rarity and limits on competition such that even high levels of relatedness may not compensate for low levels of value.

Given that the relationships between relatedness and rarity-value-limits on competition deviate from my theoretical development, the above explanations represent only speculation. However, I believe that these interesting findings will spur more theoretical and empirical research on the "compensating" role that human capital may play in decisions concerning entrepreneurial opportunity evaluation, and more generally resource acquisition.

Study 2 - Construction of a Measure of Metacognitive Awareness

In this dissertation I have conceptualized cognitive adaptability as the ability, if appropriate given the decision context and the goals and motivations of the decision-maker, to overcome – or 'think outside' – the biases embedded in existing sense-making mechanisms, such as schema, scripts, and other knowledge structures – such that adaptable decision-making implies *effective* decisions in the face of a dynamic environment. I have also suggested that metacognitive awareness represents a dynamic framework through which to investigate the cognitive processes important in promoting cognitive adaptability given dynamic contexts.

It has been suggested by scholars that research focused on the role that metacognition plays in learning and decision-making has been impeded by a lack of 'generalizable' scales designed to assess an individual's propensity to engage metacognitive processes (Schraw & Dennison, 1994). While Schraw and Dennison

offer an instrument constructed to capture metacognitive awareness, this measure was designed to be employed specifically to consider metacognitive awareness in the context of learning and education. As a result, the applicability of the scale outside an educational context was tenuous. Therefore, as a component of this dissertation I have constructed – based on the conceptual model developed in Chapter 2 – an instrument designed to capture individual differences in metacognitive awareness. I suggest that my instrument to capture metacognitive awareness offers advantages over and above the others (e.g., the measures of Schraw and Dennison, 1994; Allen & Armour-Thomas, 1993) for the following two reasons: 1) the measure developed here incorporates a means to capture the idiosyncratic influences of goals and motivations of an individual's level of metacognitive awareness and 2) the measure developed in this dissertation is a 'generalized measure' not tied contextually to any specific decision context. Further, the findings of both studies cited above are questionable based on an inadequate sample size in comparison to the number of items representative of the respective measures (Hair et al, 1998). My sample ($n = 432$) is more than double that of the two studies cited above, and is consistent with the recommendations of Hair et al (1998) in that I maintain - at minimum - a 5:1 ratio of subjects to inventory items.

Analysis suggests that my measure is reliable and valid. I assert that the scale developed here delivers to the community of researchers working in this area a measure that is both easily administered, and based on the theoretical integration of conceptualizations of metacognition grounded in both cognitive and *social* psychology.

Study 3 – Metacognition, Feedback, and Cognitive Adaptability

A consistent theme throughout this dissertation has been the importance, in the context of an entrepreneurial environment/task, of cognitive adaptability – the ability to effectively and appropriately evolve decision policies (i.e. to learn) given feedback and inputs from the environmental context in which cognitive processing is embedded. I have suggested a theoretical basis for cognitive adaptability, specifically that the engagement of metacognitive awareness facilitates cognitive adaptability given a dynamic context. Thus in the context of this Study 3 the important question became ‘how and why are individuals different in their ability to adapt decision policies in response to an evolving, changing environmental context?’ The findings reported in Study 3 suggest that, in part, metacognitive awareness is responsible for both how and why individuals differ in their ability to adapt decision policies in response to an evolving, changing environmental context.

In this study I demonstrate that metacognitive awareness is positively related to improved adaptability on entrepreneurial tasks. And while not generalizable beyond this study, such improvement appears *practically* significant (a reported 46% improvement in decision accuracy at +1 standard deviation above the mean for metacognitive awareness given cognitive feedback). Even more compelling, the findings of this study suggest that the reason that metacognitive awareness promotes cognitive adaptability may be that individuals that are highly metacognitively aware, are normatively ‘better’ than those less aware at incorporating feedback and cues from their environments in such a way as to effectively and appropriately evolve their decision policies toward improved performance. Put simply, it appears that

metcognitively aware individuals use the feedback most effectively, thus the benefits of the feedback relative to improvements in decision performance are enhanced by metacognitive awareness. I suggest that these findings specifically have profound implications for both the future directions of entrepreneurship research, as well as for interpreting and re-focusing the extant entrepreneurship literature. I detail some of those implications in what follows.

Cognitive Adaptability, Performance, and the Entrepreneurial Mindset

Beginning with McGrath and MacMillan's (2000) conceptualization of the "Entrepreneurial Mindset," entrepreneurship scholars have embraced the notion that dynamic sensemaking and decision processes are central to success in an entrepreneurial environment (Ireland, Hitt, and Sirmon, 2003). In developing the foundations of the entrepreneurial mindset, Ireland and his co-authors describe cognitive tasks such as: making sense of opportunities in the context of changing goals, constantly questioning ones 'dominant logic' in the context of a changing environment, and revisiting 'deceptively simple questions' about what we think to be true about markets the firm (Ireland, Hitt, & Sirmon, 2003). That said there has been a notable absence in the literature of work focused on somehow capturing and quantifying the cognitive underpinnings of the entrepreneurial mindset.

In Chapter 1 of this dissertation, I suggested that cognitive adaptability is representative of the cognitive origins of the entrepreneurial mindset (and other, similar conceptualizations of entrepreneurial thinking), and that cognitive adaptability can be enhanced through the development of metacognition. Conceptually, I have proposed that cognitive adaptability represents the ability, if appropriate given the

decision context and the goals and motivations of the decision-maker, to overcome – or ‘think outside’ – the biases embedded in existing sense-making mechanisms, such as schema, scripts, and other knowledge structures. This conceptualization is consistent with the antecedents of the entrepreneurial mindset, because it incorporates the recognition that decisions and sense-making occur in a complex, dynamic, and social environment.

Through this study - I have demonstrated that the origins of the ‘entrepreneurial mindset’ are, in part, cognitive in nature. My findings suggest that the behaviors characteristic of an entrepreneurial mindset described by Ireland and his co-authors above – generally the ability to adapt thinking process to a changing context and task demands - are manifest as a result of metacognitive awareness. The adaptable thinking and decision-making characteristic of an ‘entrepreneurial mindset’ was designed into this study, such that performance was assessed based on cognitive adaptability – in essence an ‘entrepreneurial mindset. I represent this study, and thus one of its contributions, as the first empirical investigation of the cognitive origins of an entrepreneurial mindset.

Metacognition as an Individual Difference Measure

The findings of this study, considered concomitantly with the measure of metacognitive awareness developed in Study 2, highlight the promise of employing metacognitive awareness as an important individual difference measure in future entrepreneurship research. Early entrepreneurship research adopted a psychological lens to study individual entrepreneurial characteristics (McGrath, MacMillan, Scheinberg, 1992; Hornaday & Aboud, 1971; Coupon & Udell, 1976; Carland, 1988).

However addressing the utility of that research in entrepreneurship, Shaver and Scott wrote that “not even the most resolute advocate for ‘enduring personality differences between entrepreneurs and non-entrepreneurs’ would argue that a complete map of the human genome will reveal a specific gene that can separate new venture founders from everyone else (1991:32).” More recently, entrepreneurship scholars have returned to their psychological roots to focus on cognitive processes of the entrepreneur (Baron, 1998; Mitchell, Busenitz, Lant, McDougall, Morse & Smith, 2002; Shepherd & Krueger, 2002) and have argued that cognition is important as a process lens through which to “reexamine the people side of entrepreneurship” (Mitchell et al, 2002).

The findings of this study highlight – generally - that the re-orientation of entrepreneurship scholars from traits to cognitive processes, as important individual difference measures in entrepreneurship research, holds promise. Further this study highlights specifically that metacognition may be an important cognitive process as related to effective decision-making and performance in an entrepreneurial context. Cognitive approaches to entrepreneurship have devoted considerable energy to defining “entrepreneurial cognitions” in an effort to identify and distinguish entrepreneurs from non-entrepreneurs (Carter, Gartner, Shaver, & Gatewood, 2003; Markman, Balkin, & Baron, 2002; Miner, Bracker, & Smith, 1989). That said metacognition, as a cognitive, individual difference measure, is new to entrepreneurship. It is my hope that the findings reported here will motivate future research directed toward the role that metacognitive awareness plays relative to

performance given entrepreneurial tasks such as opportunity recognition, discovery, and new venture creation.

Feedback, Metacognition, and an Entrepreneurial Task

One of the most interesting findings of this study – and the one that I believe makes the most significant contribution to our understanding of cognition, learning, and decision-making – is the finding of a significant, positive relationship between the interaction of feedback and metacognition, and performance on the entrepreneurial task.

As detailed in Chapter 3, research has established that cognitive feedback – feedback which provides the decision-maker with information that relates his/her own decisions with information about the decision task and the environment – is effective in promoting subsequent learning and normative improvements in decision-making (Blazer et al., 1994). My research here serves to confirm the findings of Blazer et al. and others relative to cognitive feedback, by demonstrating that cognitive feedback, presented to a decision-maker in a format consistent with Brunswick's Lens Model (1956), does promote significant normative improvements in decision accuracy given an iterative decision process.

My contribution to this literature, however, is based on the fact that the results of this study *also* demonstrate that the benefits of cognitive feedback are not conferred equally; specifically not all individuals who receive cognitive feedback realize equivalent improvements in decision accuracy. The model of situated metacognition suggests that the extent to which an individual is metacognitively aware should serve to moderate the influences of feedback on subsequent cognitive

adaptability. The findings of Study 3 provide evidence in support of this proposition. Specifically, the findings of Study 3 indicate that the impact of cognitive feedback on subsequent decision accuracy is significantly 'different' for those individuals who are highly metacognitively aware compared to those low in metacognitive awareness. Put simply, highly metacognitively aware individuals appear to use cognitive feedback more effectively than individuals who are less metacognitively aware, and this performance difference is greater for cognitive feedback than for outcome feedback. This finding has implications across a myriad of research contexts and applications and suggests compelling avenues for future research.

For example this study highlights that decision feedback is important, and thus as an extension of this research the findings suggest the importance of research focused on the extent to which entrepreneurs actively seek and subsequently incorporate feedback from their environments relating to their own decision policies. Given this general focus two, concomitant issues are central given the findings of this study. First, do entrepreneurs that exhibit behaviors which facilitate the accumulation of relational feedback as inputs to future decision process – such as seeking input from customers, suppliers, venture capitalists - perform better given entrepreneurial tasks such as opportunity recognition, evaluation, and new venture creation as compared to those who do not engage in those 'feedback search' behaviors. Further, within that sample of entrepreneurs who engage in feedback search behaviors, are those who are high on metacognition marginally better performers given the entrepreneurial tasks cited above. As an extension of the research presented here, this perspective affords a new and compelling framework through which to consider

many of the constructs related to learning and decision-making already prominent in entrepreneurship research.

For example, often the explanation for why some entrepreneurs demonstrate superior cognitive processes and outcomes, relative to others, revolves around knowledge – for example, specialized knowledge about opportunities and the generalized knowledge of how to organize specialized knowledge (Alvarez & Busenitz, 2001). Although scholars highlight the relationship between specific knowledge and opportunities (Shane 2000), to date entrepreneurship scholars have not explored “knowledge of how to organize specialized knowledge.” The findings represented in this study indicate that knowledge accumulated from the environment in the form of feedback – by itself – may be inadequate to promote effective application of that knowledge directed toward a given entrepreneurial task. My finding suggest that knowledge transfer within the entrepreneurial environment may require metacognitive awareness, and that the more metacognitively aware and capable an individual is, the more likely he or she take those inputs from the environment and evolve his/her decision policies accordingly. These finding serve as a bridge to effectively link knowledge with adaptability. Entrepreneurship scholars have explored this link (between knowledge and adaptability), but have generally only speculated as to ‘why’ knowledge may promote adaptability and subsequent entrepreneurial behaviors (Shane, 2000; Baum & Locke, 2004). The findings of this study take a step further to address the question of ‘how’ knowledge may promote adaptability, by beginning to investigate the process through which knowledge – in this study feedback – is incorporated into the decision policies of entrepreneurs.

In the next section I consider the practical implications and contributions of cognitive adaptability as reflected in the model of socially situated cognition for entrepreneurs, managers, and the pedagogy of business education.

Practical Implications

To both teach and research within the domain of business management, for me, assumes a practical orientation such that the focus of research has some implication for those managers and entrepreneurs *practicing* the tenants of business management; and also some relevance to the students in my classroom. It is for both these reasons that I believe the findings demonstrated here are important.

I have demonstrated in this study that metacognition has significant influences on performance given the opportunity to receive meaningful feedback from the environment. Recall that decision accuracy improved – at one standard deviation above the mean for metacognition – by over 45% in this study. I suggest that this magnitude of improvement is important by any standard, and highlights the potential contribution of a metacognitive lens focused on strategic decision-making across a number of management applications. Further, recall that this study also demonstrates that an individual's ability to effectively incorporate feedback from the environment – or put simply to learn - was significantly enhanced given higher (relative to others) levels of metacognition. This fact clearly has implications for the pedagogy of business education, and teaching in general. Unlike much of what we study, however, these implications can be realized given that research has repeatedly demonstrated that metacognition can be taught, and metacognitive awareness enhanced (Schmidt & Ford, 2003; Neitfeld & Schraw, 2002; Mevarech, 1999). In the

boardroom, an improvement in decision accuracy at even half of the magnitude demonstrated in this study can translate into significant financial return. In the classroom, the concomitant consideration of metacognition and feedback in the design of curriculum and teaching methodologies can enhance learning and propel 'adaptable' thinking – an attribute that this study demonstrates will pay dividends once our students become managers or entrepreneurs themselves.

Limitations of the Research Methodology

The studies representative of this dissertation share many characteristics in common relative to the limitations of the research. Both Study #1 and Study #3 were designed as experiments, and therefore share limitations generally associated with validity and reliability. Study #2, the construct validation, is also most significantly concerned with these same issues. These limitations – as well as the measures I took to mitigate the effects of each - are generally discussed below. Limitations specific to each study – beyond reliability and validity - are discussed in Chapter 4.

Content Validity

Content validity is concerned with whether the measures are actually relevant and representative of the content and consists of two types of validity—face validity and construct validity. In conjoint analysis, there is a “concern that respondent’s could place importance on attributes only because they are presented in the experiment” (Shepherd & Zacharakis, 1997: 227). It is possible that some respondents (either the entrepreneurs in Study 1, or the inexperienced entrepreneurs

in Study 3) placed importance on attributes only because they were presented in the experiment.

In order to reduce this possibility, the attributes employed in Study 1 were theoretically justified, and when pilot tested they demonstrated face validity. Further, the nature of the experimental design in Study 3 is such that I suggest that the fact that the respondents may only use the cues because they are presented in the study is not a genuine concern. My focus was on the change in decision policy given feedback, and through that feedback I explicitly direct the respondents in not only which criteria to use, but how to use them (given the weights applied to each attribute). Thus my focus was not to suggest through my findings *how* the attributes are used by the sample (which would make validity a legitimate concern), but only to demonstrate how feedback motivated a change in decision policy.

Closely related to this limitation is the fact that the attributes presented in this experiment lack the richness of real life cues. Even though this is an almost 'unavoidable' limitation of conjoint experiments because conjoint designs don't faithfully represent the decision as it appears in reality, Stewart (1993) and others assert that the method has strong validity. Research indicates the hypothetical representations, like the ones used in both Study 1 and Study 3, are useful for capturing real policies (Chaput de Saintonge & Hathaway 1981, Riquelme & Rickards 1992). Further, an argument can be made in the case of Study #3 that whether or not the decision scenarios 'faithfully represented reality' was not relevant because the sample – as

inexperienced entrepreneurs – had no basis in reality from which to judge the opportunity scenarios as representative of real life.

One concern in regard to construct validity is the limited number of attributes that can be included in a conjoint analysis. Broonn and Olson (1999) suggest that 10 is the maximum number of attributes that respondents can be expected to deal with while Shepherd and Zacharakis (1997) propose 8. In this study I included only 5 variables (maximum).

Structural validity.

Structural validity refers to the requirement that analytical methods are well matched to the theoretical construction of the variables and models. This often requires a clearly specified research model. In this research, I have defined the research model both theoretically and empirically reducing the possibility of structural validity implications.

Non-response Bias.

Non-response bias is a problem for almost every survey, and is due to the fact that results (data) may reflect an inordinate percentage of a particular demographic portion of the sample. This is because there are usually differences between the ideal sample pool of respondents and the sample that actually responds to a survey. According to Fox and Tracy, “when these differences are related to criterion measures, the results (of the study) may be misleading or even erroneous” (1986).

Clearly, one of the most effective ways to reduce the effects of non-response bias is to take steps to realize a high response rate on survey-type studies. Such steps

were taken in Study #1, and the resultant response rate (44%) is considered excellent given the nature of the study. I also tested for differences between early and late respondents and results suggest that there is no significant difference between the two groups ($p > .10$).

External Validity

External validity addresses the question of generalizability, specifically focused on “what populations, settings, treatment variables and measurement variables” can the effects demonstrated in this study be generalized” (Campbell & Stanley, 1963). One of the major concerns in conjoint analysis is that the experiment lacks external validity. Steps were taken to ensure external validity including a random sample of expert and inexperienced entrepreneurs, which are described in detail in Chapter 4.

Reliability

Reliability refers to the extent to which a variable is consistent in what it is intended to measure. If multiple measures are taken they should be consistent in their values. In order to measure reliability in the conjoint analysis, I replicated the profiles fully to allow for a comparison of the original profiles with the replicated one. Individual reliabilities were strong and consistent with previous research. Individual reliabilities are reported at Appendix x.

Conclusion

Like many entrepreneurship scholars, in this dissertation I was motivated to investigate the influences of cognition on entrepreneurial tasks and subsequent

outcomes. However – as reflected in this dissertation – my approach to developing a research program directed towards that end represents a subtle, but important departure from the extant conventions of cognition research in entrepreneurship.

As this dissertation highlights, generally entrepreneurial cognition research is situated around theory development and testing focused on the role of cognitive processes in *inhibiting* the entrepreneur from realizing marginally ‘better’ performance given a wide range of entrepreneurial tasks and behaviors. The distinction I am interested in highlighting is akin to the “glass half-empty” metaphor, such that the focus of entrepreneurial cognition research generally frames the role of human cognition as an impediment to superior performance; the role of bias, scripts, counterfactual thinking, and even memory and recall - as *framed* in our literature - represents a ‘glass half-empty’ approach to exploring the relationship between cognition and entrepreneurship. I suggest this as the case because the extant literature is focused on the negative consequences that these cognitive mechanisms have on entrepreneurial decision-making and subsequent performance.

It was my intention to bring a ‘glass half-full’ perspective to this research, such that my approach to the development and testing of theory is focused on cognition as a valuable resource, or as a ‘tool’ through which the entrepreneur may realize marginally ‘better’ performance given a dynamic environment. I believe this approach is reflected in both the development of the theory and design of the studies representative of this dissertation.

For example, the conceptualization of my dependent variable – cognitive adaptability – is reflective of this ‘glass half-full’ approach to entrepreneurial

cognitive research. I focus on the normative implications of adaptable thinking given a dynamic context. In this case those normative implications are based on heterogeneity in individual goals and motivations of the entrepreneur thus addressing another tenuously-held convention in entrepreneurial cognition research, specifically the assumed homogeneity in the treatment of the influences of goals, motivations, and environmental context on cognitive processing. Further, in this dissertation I do more than simply highlight the benefits of cognitive adaptability, but I explore the antecedents to adaptability and begin the process of quantifying those benefits in an entrepreneurial context. Finally, I contribute a robust, testable, theoretical model to the study of entrepreneurial cognition that brings with it the implication of *hopefulness* rather than *hopelessness* to the relationship between cognition and entrepreneurial behaviors and performance.

I propose in this dissertation - through my research question - that metacognition represents the antecedent to cognitive adaptability, and that cognitive adaptability improves performance on entrepreneurial tasks. My findings here suggest that cognitive adaptability is important in an entrepreneurial context, and that metacognition does promote cognitive adaptability and thus improve performance on an entrepreneurial task. The concomitant implications of my theoretical model and empirical findings are hopeful in that metacognition can be learned, thus cognitive adaptability can be enhanced – begetting improved entrepreneurial performance.

Why is it that entrepreneurs ‘think’ differently about a given entrepreneurial task (and subsequently behave differently)? By bringing together literatures from social psychology and metacognition in a model of socially situated metacognition, I

suggest that this difference is not necessarily due to inherent differences in entrepreneurs in cognitive ability or process – thus *hopeless* – but to an interpretation of the conjoint influences of motivation and context which, in turn, may result in disparate cognitive strategies employed to realize some outcome. This framework represents an important step forward toward realizing the stated goal of many entrepreneurship scholars, ‘opening the back box’ of entrepreneurial cognition to fully understand the relationship between cognition and performance in an entrepreneurial environment. As such, I suggest my approach to this dissertation – focusing on the processes that may promote adaptable thinking rather than inhibit it – represents one of the major contributions to the body of entrepreneurship research.

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APPENDIX A
(Study 1 – Post Experiemnt Questionnaire)

* Your gender? Female ☐ Male ☐

* Your age? ☐ ☐ ☐ ☐ ☐ ☐
 < 25 25-34 35-44 45-54 55-64 > 65

* The highest level of formal education you completed? High school ☐ Masters Degree ☐
 Some College ☐ Ph.D. Degree ☐
 Bachelor Degree ☐
 Others (please specify) _____

* The educational major of the highest level of formal education you completed? Business ☐ Science ☐
 Law ☐ Engineering ☐
 Arts / Humanities ☐
 Others (please specify) _____

* Are you the (or one of the) principal founder(s) of the firm you are associated with? Yes ☐ No ☐

* How many years have you been 'an entrepreneur?'
 (in you do not consider yourself an entrepreneur, put "0") _____ years

* At present, are you actively seeking new opportunities to pursue? Yes ☐ No ☐

* Approximately how many opportunities have you seriously evaluated/considered in the last 12 months? 1-5 6-10 11-15 16-20 21-25 <25
 ☐ ☐ ☐ ☐ ☐ ☐

* In your opinion, what percentage of the opportunities that you seriously considered do you/your firm end up exploiting (expending resources to pursue)?

 Less than 5% 5-20% 20-40% 40-60% 60-80% 80-95% More than 95%

APPENDIX A, page 2

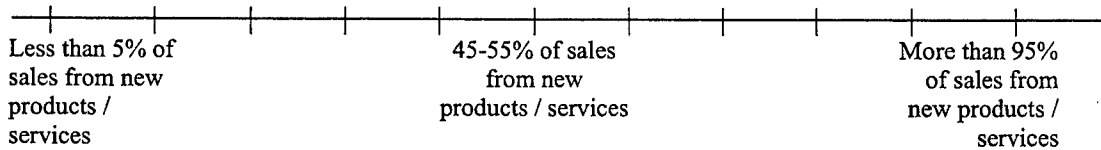
Main characteristics of the firm you are associated with:

Instructions: Using an 'x' or a '✓', please answer the following questions.

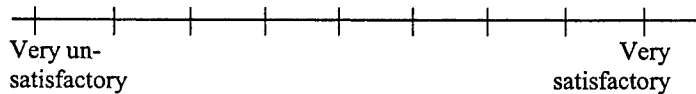
* If you are currently associated with a firm, when was it founded? _____

(year)

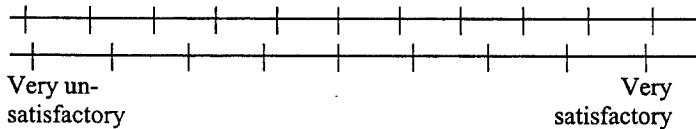
* Approximately how large a share of your total sales is generated from products/services that you were **NOT** selling **three years ago** (relative to products/services you already had)?



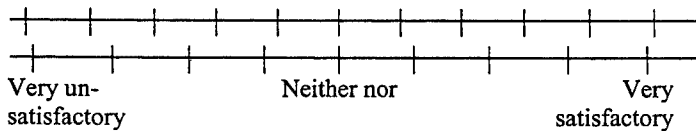
* From your perspective, has the firm's growth in new product/service development over the last three years been satisfactory, or unsatisfactory?



* From your perspective, is the firm's **current** level of profitability satisfactory, or unsatisfactory?



* From your perspective, has the firm's profitability growth over the last three years been satisfactory, or unsatisfactory?



* Considering only items that are important to your firm, or in the context of the environment you operate as an entrepreneur, on a scale of 1-10, rate the frequency at which each of these items change? If it does not change, leave it blank:

(score of 1-10)

1. Distributors of product/service: _____
2. Actual users of product/service: _____
3. Suppliers of parts/materials: _____
4. Labor supply: _____

APPENDIX A, page 3

5. Suppliers of capital: _____
6. Competition for supplies: _____
7. Competition for customers: _____
8. Government regulations: _____
9. Public's attitude toward product/service: _____
10. Meeting new technology requirements: _____

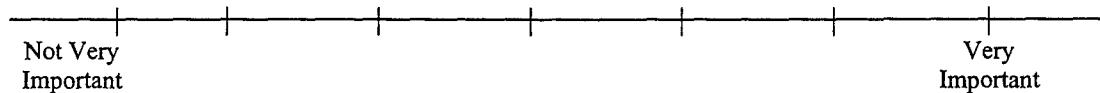
Opportunity Assessment:

Instructions:

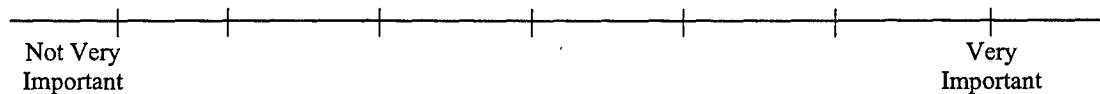
Please answer the following questions:

* Given the five criteria of opportunity assessment presented in this study, please indicate on the scale below how you would weight the importance of each criteria relative to the process of assessing entrepreneurial opportunities:

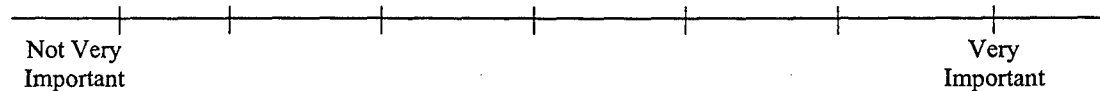
Value:



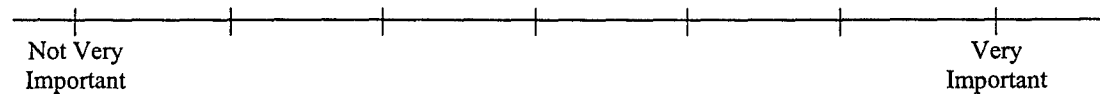
Relatedness:



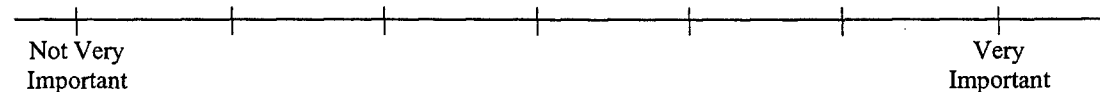
Rarity:



Limits of Competition:




Imitability/Substitutability:




APPENDIX B
Study 2 - Metacognitive Awareness Inventory


1. I think of several ways to solve a problem and choose the best one. (2)

NOT Very Much Like Me		Very Much Like Me
--------------------------	--	----------------------


2. I challenge my own assumptions about a task before I begin. (3)

NOT Very Much Like Me		Very Much Like Me
--------------------------	--	----------------------


3. I think about how others may react to my actions. (6)

NOT Very Much Like Me		Very Much Like Me
--------------------------	--	----------------------


4. I find myself automatically employing strategies that have worked in the past. (8)

NOT Very Much Like Me		Very Much Like Me
--------------------------	--	----------------------

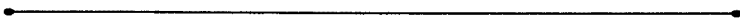
5. I think about what I really need to accomplish before I begin a task. (9)

NOT Very Much Like Me		Very Much Like Me
--------------------------	--	----------------------


6. I ask myself if I have considered all the options when solving a problem. (11)

NOT Very Much Like Me		Very Much Like Me
--------------------------	--	----------------------


7. I perform best when I already have knowledge of the task. (15)

NOT Very Much Like Me		Very Much Like Me
--------------------------	--	----------------------


8. I often define goals for myself. (17)

NOT Very Much Like Me		Very Much Like Me
--------------------------	--	----------------------

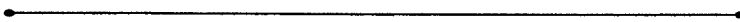
9. I use different strategies depending on the situation. (18)

NOT Very Much Like Me		Very Much Like Me
--------------------------	--	----------------------

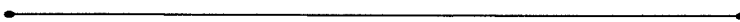
10. I create my own examples to make information more meaningful. (21)

NOT Very Much Like Me		Very Much Like Me
--------------------------	--	----------------------

11. I try to use strategies that have worked in the past. (22)

NOT Very Much Like Me		Very Much Like Me
--------------------------	--	----------------------

12. I ask myself questions about the task before I begin. (23)

NOT Very Much Like Me		Very Much Like Me
--------------------------	--	----------------------

APPENDIX B, page 2

13. I try to translate new information into my own words. (25)

NOT Very Much Like Me	•—————•	Very Much Like Me
--------------------------	---------	----------------------

14. I organize my time to best accomplish my goals. (28)

NOT Very Much Like Me	•—————•	Very Much Like Me
--------------------------	---------	----------------------

15. I am good at organizing information. (29)

NOT Very Much Like Me	•—————•	Very Much Like Me
--------------------------	---------	----------------------

16. I try to break problems down into smaller components. (30)

NOT Very Much Like Me	•—————•	Very Much Like Me
--------------------------	---------	----------------------

17. I know what kind of information is most important to consider when faced with a problem. (33)

NOT Very Much Like Me	•—————•	Very Much Like Me
--------------------------	---------	----------------------

18. I consciously focus my attention on important information. (34)

NOT Very Much Like Me	•—————•	Very Much Like Me
--------------------------	---------	----------------------

19. My 'gut' tells me when a given strategy I use will be most effective. (35)

NOT Very Much Like Me	•—————•	Very Much Like Me
--------------------------	---------	----------------------

20. I ask myself if there was an easier way to do things after I finish a task. (36)

NOT Very Much Like Me	•—————•	Very Much Like Me
--------------------------	---------	----------------------

21. I depend on my intuition to help me formulate strategies. (37)

NOT Very Much Like Me	•—————•	Very Much Like Me
--------------------------	---------	----------------------

22. I periodically review to help me understand important relationships. (38)

NOT Very Much Like Me	•—————•	Very Much Like Me
--------------------------	---------	----------------------

23. I stop and go back over information that is not clear. (41)

NOT Very Much Like Me	•—————•	Very Much Like Me
--------------------------	---------	----------------------

24. I am aware of what strategies I use when engaged in a given task. (42)

NOT Very Much Like Me	•—————•	Very Much Like Me
--------------------------	---------	----------------------

APPENDIX B, page 3

25. I find myself analyzing the usefulness of a given strategy while engaged in a given task. (43)

NOT Very Much Like Me	<input type="radio"/>	Very Much Like Me
--------------------------	-----------------------	----------------------

26. I understand how accomplishment of a task relates to my goals. (44)

NOT Very Much Like Me	<input type="radio"/>	Very Much Like Me
--------------------------	-----------------------	----------------------

27. I find myself pausing regularly to check my comprehension of the problem or situation at hand. (45)

NOT Very Much Like Me	<input type="radio"/>	Very Much Like Me
--------------------------	-----------------------	----------------------

28. I ask myself questions about how well I am doing while I am performing a novel task. (46)

NOT Very Much Like Me	<input type="radio"/>	Very Much Like Me
--------------------------	-----------------------	----------------------

29. I stop and re-read when I get confused. (47)

NOT Very Much Like Me	<input type="radio"/>	Very Much Like Me
--------------------------	-----------------------	----------------------

30. I focus on the meaning and significance of new information. (48)

NOT Very Much Like Me	<input type="radio"/>	Very Much Like Me
--------------------------	-----------------------	----------------------

31. I set specific goals before I begin a task. (49)

NOT Very Much Like Me	<input type="radio"/>	Very Much Like Me
--------------------------	-----------------------	----------------------

32. I ask myself if I have considered all the options after I solve a problem. (50)

NOT Very Much Like Me	<input type="radio"/>	Very Much Like Me
--------------------------	-----------------------	----------------------

33. I ask myself how well I've accomplished my goals once I've finished. (51)

NOT Very Much Like Me	<input type="radio"/>	Very Much Like Me
--------------------------	-----------------------	----------------------

34. I re-evaluate my assumptions when I get confused. (52)

NOT Very Much Like Me	<input type="radio"/>	Very Much Like Me
--------------------------	-----------------------	----------------------

35. When performing a task, I frequently assess my progress against my objectives. (53)

NOT Very Much Like Me	<input type="radio"/>	Very Much Like Me
--------------------------	-----------------------	----------------------

36. I ask myself if I have learned as much as I could have when I finished the task. (54)

NOT Very Much Like Me	<input type="radio"/>	Very Much Like Me
--------------------------	-----------------------	----------------------

APPENDIX C

Regulatory Focus Questionnaire – Higgins, Friedman, Harlow, Idson, Ayduk, and Taylor, 2001

1. Compared to most people, are you typically unable to get what you want out of life?

Never		Sometimes		Very often
1	2	3	4	5

2. Growing up, would you ever “cross the line” by doing things your parents would not tolerate?

Never		Sometimes		Very often
1	2	3	4	5

3. How often have you accomplished things that got you “psyched” to work even harder?

Never		A few times		Many times
1	2	3	4	5

4. Did you get on your parents’ nerves often when you were growing up?

Never		Sometimes		Very often
1	2	3	4	5

5. How often did you obey rules and regulations that were established by your parents?

Never		Sometimes		Always
1	2	3	4	5

6. Growing up, did you ever act in ways that your parents thought were objectionable?

Never		Sometimes		Very often
1	2	3	4	5

7. Do you do well at different things that you try?

Never		Sometimes		Very often
1	2	3	4	5

8. Not being careful enough has gotten me into trouble at times.

Rarely		A few times		Many times
1	2	3	4	5

9. When it comes to achieving things that are important to me, I find that I don’t perform as well as I ideally would like to do.

Never		Sometimes		Very often
1	2	3	4	5

10. I feel like I have made progress toward being successful in my life.

Certainly false				Certainly true
1	2	3	4	5

11. I have found few activities in my life that capture my interest or motivate me to put effort into them.

Certainly false				Certainly true
1	2	3	4	5

APPENDIX D

Need for Cognition Scale - J. T. Cacioppo, R. E. Petty, and C. F. Kao, 1984

1 = extremely uncharacteristic; 2 = somewhat uncharacteristic; 3 = uncertain; 4 = somewhat characteristic; 5 = extremely characteristic.

Item number	Item wording	Item scoring
1.	I would prefer complex to simple problems.	
2.	I like to have the responsibility of handling a situation that requires a lot of thinking.	
3.	Thinking is not my idea of fun.	Reverse scored
4.	I would rather do something that requires little thought than something that is sure to challenge my thinking abilities.	Reverse scored
5.	I try to anticipate and avoid situations where there is likely a chance I will have to think in depth about something.	Reverse scored
6.	I find satisfaction in deliberating hard and for long hours.	
7.	I only think as hard as I have to.	Reverse scored
8.	I prefer to think about small, daily projects to long-term ones.	Reverse scored
9.	I like tasks that require little thought once I've learned them.	Reverse scored
10.	The idea of relying on thought to make my way to the top appeals to me.	
11.	I really enjoy a task that involves coming up with new solutions to problems.	
12.	Learning new ways to think doesn't excite me very much.	Reverse scored
13.	I prefer my life to be filled with puzzles that I must solve.	
14.	The notion of thinking abstractly is appealing to me.	
15.	I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.	
16.	I feel relief rather than satisfaction after completing a task that required a lot of mental effort.	Reverse scored
17.	It's enough for me that something gets the job done; I don't care how or why it works.	Reverse scored
18.	I usually end up deliberating about issues even when they do not affect me personally.	

APPENDIX E

Conservatism-Liberalism Scale (Mehrabian, 1996)

Mehrabian (1996) Conservatism-Liberalism Scale

Please use the following scale to indicate the degree of your agreement or disagreement with each of the statements below. Record your numerical answer to each statement in the space provided preceding the statement. Try to describe your attitudes accurately and generally.

- +4 = very strong agreement
- +3 = strong agreement
- +2 = moderate agreement
- +1 = slight agreement
- 0 = neither agreement nor disagreement
- 1 = slight disagreement
- 2 = moderate disagreement
- 3 = strong disagreement
- 4 = very strong disagreement

- (-) _____ 1. I am politically more liberal than conservative.
- (+) _____ 2. In any election, given a choice between a Republican and a Democratic candidate, I will select the Republican over the Democrat.
- (+) _____ 3. Communism has been proven to be a failed political ideology.
- (-) _____ 4. I cannot see myself ever voting to elect conservative candidates.
- (+) _____ 5. The major national media are too left-wing for my taste.
- (-) _____ 6. Socialism has many advantages over capitalism.
- (-) _____ 7. On balance, I lean politically more to the left than to the right.

APPENDIX F **Study 3 – Post Experiment Questionnaire**

Instructions:

Please answer the following questions by placing an √ in the box that describes you:

1. Your gender? Female ☐ Male ☐

2. Your age? ☐ ☐ ☐ ☐ ☐ ☐
 < 18 18-20 21-23 24-26 27-29 >30

3. What is your major? Business ☐ Engineering ☐
 Psychology ☐ Political Science ☐
 Undecided ☐

Others (please specify) _____

4. Year of Study? ☐ ☐ ☐ ☐ ☐ ☐
 Freshmen Sophomore Junior Senior 5-year Other

5. If a Business Major, your primary focus area is? Accounting ☐ Finance ☐
 Marketing ☐ Management ☐
 Operations/Logistics ☐ Not applicable ☐

Other (please specify) _____

Questions about the Study you have just completed:

Instructions: By circling the appropriate number on the scale provided after each question, indicate how each item describes you:

1. How interesting did you find this study?

Not at All		Somewhat		Considerable
1	2	3	4	5

2. How much effort did you expend in completing the study tasks?

Not at All		Somewhat		Considerable
1	2	3	4	5

Note : The Regulatory Focus and Need for Cognition Scale – attached here in separate Appendices – were included as part of this questionnaire.

APPENDIX G **Study 1 – An Entrepreneurial Task – Individual Level Results**

Study 1 – An Entrepreneurial Task																					
Person	β Value	t-ratio	β Parity	t-ratio	β Limits	t-ratio	β Inability	t-ratio	β Relate	t-ratio	β Rel'Value	t-ratio	β Rel'Rate	t-ratio	β Rel'Limits	t-ratio	β Rel'Limit	t-ratio	R ²	F-Statistic	Reliability
1	0.838	14.265	0.113	1.928	0.181	3.084	-0.136	-2.313	0.363	6.169	0.159	2.699	0.023	0.386	0.000	0.000	0.000	0.000	0.924	29.730	0.944
2	0.583	7.176	0.204	2.503	0.258	3.171	0.204	2.503	0.502	6.174	0.014	0.167	-0.312	-3.838	0.014	0.167	0.122	1.502	0.855	14.360	0.813
3	0.616	8.082	0.180	2.357	0.359	4.715	0.180	2.357	0.488	6.398	0.051	0.674	-0.231	-3.031	0.000	0.000	0.077	1.010	0.872	16.695	0.866
4	0.610	7.520	0.162	1.995	0.361	4.451	0.112	1.381	0.510	6.292	0.037	0.460	-0.211	-2.609	0.037	0.460	0.087	1.074	0.855	14.470	0.868
5	0.572	8.012	0.165	2.315	0.318	4.451	0.114	1.602	0.546	7.656	-0.013	-0.178	-0.318	-4.451	0.038	0.534	0.140	1.959	0.888	19.390	0.934
6	0.575	9.201	0.330	5.286	0.355	5.677	-0.306	-4.894	0.502	8.027	-0.012	-0.196	0.037	0.587	-0.037	-0.587	-0.012	-0.196	0.914	25.999	0.962
7	0.903	16.326	0.146	2.643	0.129	2.332	-0.112	-2.021	0.129	2.332	0.163	2.954	0.026	0.466	0.043	0.777	0.146	2.643	0.933	33.892	0.922
8	0.580	13.000	0.178	4.000	0.178	4.000	0.089	2.000	0.669	15.000	0.312	7.000	0.000	0.000	-0.045	-1.000	0.045	1.000	0.956	53.444	0.960
9	0.677	7.682	0.120	1.356	0.359	4.067	-0.139	-1.582	0.359	4.067	0.139	1.582	0.020	0.226	-0.139	-1.582	-0.199	-2.259	0.829	11.842	0.744
10	0.365	5.043	0.055	0.764	0.608	8.405	-0.321	-4.432	0.476	6.571	0.166	2.292	0.122	1.681	-0.077	-1.070	-0.033	-0.458	0.885	18.769	0.910
11	0.802	12.819	0.164	2.619	0.216	3.446	-0.095	-1.516	0.302	4.824	0.285	4.549	-0.078	-1.241	-0.095	-1.516	0.009	0.138	0.914	25.907	0.903
12	0.765	7.888	0.247	2.548	0.200	2.063	-0.059	-0.607	0.200	2.063	0.247	2.548	-0.035	-0.364	0.012	0.121	-0.012	-0.121	0.793	9.361	0.768
13	0.742	7.741	0.231	2.411	0.182	1.904	-0.158	-1.650	0.255	2.665	0.034	0.275	-0.123	-1.008	-0.034	-0.275	0.056	0.458	0.673	5.020	0.533
14	0.564	6.335	0.172	1.928	0.343	3.856	0.098	1.102	0.515	5.784	0.025	0.275	-0.270	-3.030	0.049	0.551	0.098	1.102	0.826	11.573	0.802
15	0.532	4.279	0.111	0.896	0.433	3.483	0.161	1.294	0.334	2.687	-0.136	-1.095	-0.102	-1.000	0.111	0.896	0.087	0.697	0.660	4.736	0.523
16	0.436	3.572	0.190	1.557	0.413	3.389	-0.212	-1.740	0.458	3.756	0.034	0.275	-0.123	-1.008	-0.034	-0.275	-0.048	-0.376	0.647	4.479	0.442
17	0.391	3.085	0.257	2.032	0.181	1.430	-0.162	-1.279	0.581	4.590	0.162	1.279	-0.010	-0.075	-0.048	-0.376	-0.048	-0.376	0.647	4.479	0.442
18	0.349	4.195	0.218	2.622	0.087	1.049	-0.044	-0.524	0.699	8.390	0.349	4.195	0.218	2.622	0.087	1.049	-0.044	-0.524	0.847	13.567	0.935
19	0.812	13.188	0.148	2.411	0.201	3.262	-0.096	-1.560	0.306	4.963	0.288	4.680	-0.026	-0.425	-0.079	-1.276	0.044	0.709	0.917	26.851	0.929
20	0.708	8.202	0.146	1.697	0.220	2.546	0.268	3.111	0.268	3.111	0.293	3.394	-0.073	-0.849	-0.098	-1.131	-0.146	-1.697	0.836	12.489	0.852
21	0.664	24.612	0.105	3.886	0.571	21.158	-0.361	-13.385	0.268	9.931	-0.012	-0.432	-0.012	-0.432	0.035	1.295	0.035	1.295	0.984	150.002	0.987
22	0.723	14.231	0.082	1.621	0.156	3.062	0.137	2.702	0.577	11.348	0.192	3.783	0.027	0.540	-0.009	-0.180	0.009	0.180	0.943	40.586	0.935
23	0.581	15.556	0.264	7.071	0.581	15.556	0.422	11.314	0.211	5.657	0.000	0.000	0.000	0.000	0.000	0.000	-0.053	-1.414	0.969	77.333	0.964
24	0.459	5.265	0.325	3.724	0.325	3.724	-0.101	-1.156	0.571	6.549	0.190	2.183	0.190	2.183	-0.034	-0.385	0.034	0.385	0.833	12.169	0.718
25	0.571	5.014	0.297	2.607	0.411	3.610	-0.114	-1.003	0.320	2.808	0.091	0.802	-0.046	-0.401	0.068	0.602	0.046	0.401	0.715	6.131	0.690
26	0.455	4.341	0.037	0.352	0.209	1.995	-0.061	-0.587	0.480	4.576	0.234	2.229	-0.086	-0.821	-0.061	-0.587	0.455	4.341	0.758	7.674	0.575
27	0.374	4.442	0.225	2.685	0.717	8.503	-0.053	-0.635	0.332	3.934	-0.011	-0.127	-0.032	-0.381	0.075	0.888	-0.139	-1.650	0.844	13.187	0.798
28	0.421	3.998	0.239	2.042	0.444	3.793	-0.102	-0.875	0.466	3.987	-0.011	-0.097	-0.193	-1.653	-0.034	-0.292	-0.034	-0.292	0.699	5.676	0.542
29	0.690	5.994	0.197	1.713	0.197	1.713	-0.049	-0.428	0.296	2.569	0.246	2.141	-0.049	-0.428	0.000	0.000	-0.049	-0.428	0.709	5.948	0.666
30	0.499	4.801	0.181	1.746	-0.499	-4.801	0.318	3.055	0.295	2.837	0.091	0.873	-0.136	-1.309	-0.091	-0.873	0.091	0.873	0.762	7.836	0.666
31	0.353	3.218	0.163	1.485	0.407	3.713	-0.515	-4.703	0.298	2.723	0.054	0.495	-0.244	-2.228	-0.054	-0.495	0.000	0.000	0.736	6.816	0.678
32	0.602	7.524	0.109	1.357	0.543	6.784	-0.306	-3.824	0.089	1.110	-0.049	-0.617	-0.227	-2.837	-0.109	-1.357	0.148	1.850	0.859	14.892	0.789
33	0.685	8.814	0.021	0.275	0.407	5.233	-0.214	-2.754	0.407	5.233	0.043	0.551	-0.107	-1.377	0.021	0.275	-0.086	-1.102	0.867	15.956	0.816
34	0.434	6.206	0.340	4.864	0.270	3.658	-0.340	-4.864	0.598	8.554	-0.012	-0.168	-0.059	-0.839	-0.129	-1.845	0.152	2.180	0.893	20.309	0.858
35	0.753	9.029	0.311	3.732	0.231	2.769	-0.291	-3.491	0.131	1.565	0.050	0.602	-0.110	-1.324	-0.110	-1.324	-0.030	-0.361	0.847	13.528	0.869

$F > 6.98 = p < .05$; $t > 2.65 = p < .05$; $R^2 > .830 = p > .05$; Reliability $> .552 = p < .05$

APPENDIX G, page 2
Study 1 – An Entrepreneurial Task – Individual Level Results

Person	β Value	t -ratio	β Rarity	t -ratio	β Limits	t -ratio	β Immutability	t -ratio	β Relate	t -ratio	β RelValue	t -ratio	β RelRare	t -ratio	β RelLimits	t -ratio	β RelMit	t -ratio	R^2	F-Statistic	Reliability
36	0.580	7.792	0.283	3.657	0.354	4.930	-0.468	-6.520	0.377	5.248	0.011	0.169	-0.057	-0.795	-0.057	-0.795	-0.103	-1.431	0.886	19.086	0.898
37	0.600	8.098	0.107	1.446	0.407	5.495	-0.236	-3.181	0.515	6.941	0.064	0.868	0.086	-0.578	-0.043	-0.578	-0.086	-1.157	0.879	17.771	0.840
38	0.235	2.277	0.353	3.415	0.420	4.065	0.269	2.602	0.504	4.878	0.034	0.325	-0.218	-2.114	0.084	0.813	0.168	1.626	0.766	7.980	0.759
39	0.387	3.364	0.161	1.402	-0.097	-0.841	0.000	0.000	0.452	3.924	0.549	4.765	0.000	0.000	0.032	0.280	-0.129	-1.121	0.708	5.937	0.571
40	0.400	3.302	0.306	2.525	0.282	2.331	-0.118	-0.971	0.541	4.468	0.141	1.166	-0.094	-0.777	-0.024	-0.194	0.094	0.777	0.678	5.136	0.498
41	0.685	10.425	0.443	6.746	0.222	3.373	-0.060	-0.920	0.343	5.213	0.242	3.679	0.000	0.000	-0.101	-1.533	0.020	0.307	0.905	23.285	0.909
42	0.793	9.718	0.126	1.546	0.270	3.313	0.018	-3.174	0.479	7.708	0.000	0.000	-0.056	-0.907	0.028	0.453	-0.056	-0.907	0.915	26.341	0.924
43	0.535	8.615	0.310	4.988	0.507	8.162	-0.197	-13.360	-0.347	-9.463	-0.061	-1.670	-0.041	-1.113	-0.020	-0.309	0.155	1.670	0.886	19.016	0.855
44	0.490	13.360	0.347	9.463	0.490	13.360	-0.490	-7.026	0.397	5.019	-0.057	-0.717	-0.057	-0.717	0.057	0.717	-0.057	-0.717	0.862	15.318	0.784
45	0.377	5.246	0.089	1.234	0.400	5.555	0.266	3.703	0.688	9.567	0.044	-0.617	-0.067	-0.926	0.022	0.309	0.155	1.670	0.886	19.016	0.855
46	0.170	2.151	0.306	3.872	0.510	6.453	-0.556	-7.026	0.397	5.019	-0.057	-0.717	-0.057	-0.717	0.057	0.717	-0.057	-0.717	0.862	15.318	0.784
47	0.520	4.553	0.198	1.735	0.421	3.886	0.396	3.469	0.099	0.867	-0.173	-1.518	-0.050	-0.434	-0.074	-0.650	0.149	1.301	0.713	6.080	0.544
48	0.676	9.825	0.305	4.437	0.196	2.853	-0.240	-3.486	0.480	6.973	0.044	0.634	-0.022	-0.317	-0.131	-1.902	0.000	0.000	0.896	21.029	0.849
49	0.467	3.426	0.290	2.130	0.442	3.241	-0.013	-0.093	0.164	1.204	0.063	0.463	-0.114	-0.833	-0.063	-0.463	-0.215	-1.574	0.591	3.537	0.684
50	0.393	4.390	0.227	2.536	0.599	6.685	0.145	1.614	0.434	4.841	0.103	1.153	-0.062	-0.692	0.186	2.075	-0.021	-0.231	0.823	11.390	0.892
51	0.299	4.162	0.100	1.387	0.343	4.778	0.365	5.087	0.719	10.019	-0.033	-0.462	-0.055	-0.771	0.011	0.154	0.122	1.696	0.887	19.115	0.842
52	0.251	3.527	0.182	2.565	0.319	4.489	0.433	6.092	0.706	9.940	0.023	0.321	0.000	0.000	0.000	0.000	0.068	0.962	0.889	19.567	0.828
53	0.568	9.068	0.379	6.045	0.460	7.340	-0.108	-1.727	0.460	7.340	0.081	1.295	0.000	0.000	-0.081	-1.295	0.000	0.000	0.914	25.874	0.913
54	0.436	3.548	0.253	2.054	0.368	2.988	-0.161	-1.307	0.459	3.734	0.092	0.747	-0.138	-1.120	-0.069	-0.560	0.092	0.747	0.667	4.897	0.504
55	0.585	9.274	0.247	3.916	0.533	8.449	0.429	6.801	0.169	2.679	-0.039	-0.618	0.039	0.618	0.013	0.206	-0.091	-1.443	0.912	25.450	0.872
56	0.674	6.536	0.061	0.594	0.257	2.495	0.257	2.495	0.233	2.258	0.282	2.733	-0.037	-0.356	-0.086	-0.832	-0.184	-1.782	0.766	8.010	0.813
57	0.588	7.869	0.109	1.457	0.414	5.538	-0.218	-2.914	0.522	6.995	0.087	1.166	0.087	1.166	-0.044	-0.583	-0.109	-1.457	0.877	17.479	0.842
58	0.655	8.306	0.122	1.549	0.300	3.801	-0.211	-2.675	0.500	6.335	0.078	0.985	0.122	1.549	-0.100	-1.267	0.056	0.704	0.863	15.400	0.861
59	0.588	11.323	0.204	3.919	0.158	3.048	0.136	2.613	0.634	12.194	0.317	6.097	-0.023	-0.435	-0.068	-1.306	0.045	0.871	0.941	38.690	0.920
60	0.432	3.290	0.432	3.290	0.105	0.800	0.058	0.445	0.455	3.468	0.082	0.622	0.082	0.622	-0.105	-0.800	-0.058	-0.445	0.622	4.015	0.588
61	0.600	8.889	0.216	3.200	0.120	1.778	0.120	1.778	0.600	8.889	0.312	4.623	0.024	0.356	-0.072	-1.067	0.024	0.356	0.900	21.930	0.845
62	0.555	7.472	0.210	2.823	0.259	3.487	0.086	1.162	0.580	7.804	0.012	0.166	-0.284	-3.819	0.012	0.166	0.185	2.491	0.878	17.672	0.881
63	0.391	3.772	0.257	2.479	0.481	4.634	-0.056	-0.539	0.481	4.634	-0.078	-0.754	-0.257	-2.479	-0.034	-0.323	-0.078	-0.754	0.763	7.890	0.645
64	0.568	4.964	0.296	2.581	0.386	3.376	-0.114	-0.993	0.341	2.978	0.114	0.993	-0.023	-0.199	0.068	0.596	0.068	0.596	0.712	6.032	0.703
65	0.377	2.488	0.400	2.639	0.103	0.679	-0.057	-0.377	0.354	2.337	0.126	0.829	0.103	0.679	0.126	0.829	0.103	0.679	0.494	2.391	0.573
66	0.563	6.839	0.248	3.009	0.338	4.103	-0.428	-5.197	0.383	4.650	0.023	0.274	-0.068	-0.821	-0.113	-1.368	-0.113	-1.368	0.851	13.977	0.843
67	0.550	8.723	0.282	4.468	0.496	7.872	-0.174	-2.766	0.496	7.872	-0.040	-0.638	-0.040	-0.638	0.013	0.213	-0.067	-0.714	0.749	7.308	0.659
68	0.432	4.048	0.381	3.572	0.229	2.143	0.025	0.238	0.508	4.762	-0.127	-1.191	0.229	2.143	-0.178	-1.667	-0.076	-0.714	0.749	7.308	0.659
69	0.405	3.979	0.289	2.842	0.104	1.023	0.035	0.341	0.590	5.798	0.335	3.297	0.173	1.705	0.081	0.796	-0.127	-1.251	0.772	8.297	0.858
70	0.341	3.946	0.209	2.418	0.692	8.019	-0.011	-0.127	0.406	4.709	-0.033	-0.382	-0.033	-0.382	0.055	0.636	-0.165	-1.909	0.836	12.472	0.793
71	0.355	4.029	0.266	3.022	0.688	7.806	-0.089	-1.007	0.333	3.777	-0.067	-0.755	-0.067	-0.755	0.089	1.007	-0.155	-1.763	0.829	11.870	0.745
72	0.675	9.956	0.265	3.911	0.193	2.845	-0.217	-3.200	0.507	7.467	0.096	1.422	0.024	0.356	-0.145	-2.133	-0.024	-0.356	0.899	21.705	0.855
73	0.613	7.861	0.397	5.087	0.397	5.087	-0.277	-3.545	0.301	3.853	0.036	0.462	0.060	0.771	0.060	0.771	0.012	0.154	0.866	15.820	0.816
Means	0.267		0.132		0.180		-0.020		0.221		0.039		-0.012		-0.011		-0.007		0.426		0.412

$F > 6.98 = p < .05$; $t > 2.65 = p < .05$; $R^2 > .830 = p > .05$; Reliability $> .552 = p < .05$

APPENDIX H **Study 3, Part 1 – Individual Level Results**

Person	Conjoint Analysis 1										Conjoint Analysis 2									
	β Value	t-statistic	β Rank	t-statistic	R^2	F-Statistic	Reliability	β Value	t-statistic	β Rank	t-statistic	β Rank	t-statistic	R^2	F-Statistic	Reliability	β Value	t-statistic	β Rank	t-statistic
1	0.573	9.000	0.573	9.000	0.984	81.000	0.978	0.460	3.742	0.328	2.573	0.328	2.573	0.940	20.762	0.957	-0.788	-6.414	0.940	0.940
2	0.732	7.348	0.651	6.532	0.960	32.222	0.937	0.490	5.814	0.566	6.708	0.566	6.708	0.972	45.533	0.855	-0.641	-7.603	0.972	0.972
3	0.472	7.506	0.617	6.815	0.984	83.000	0.971	0.577	3.000	0.577	5.000	0.577	5.000	1.000	6.780	0.690	-0.577	-6.414	1.000	1.000
4	0.547	7.603	0.571	7.603	0.977	57.800	0.976	0.460	3.742	0.328	2.573	0.328	2.573	0.940	20.762	0.735	-0.788	-6.414	0.940	0.940
5	0.547	8.660	0.547	8.660	0.984	82.111	0.978	0.503	3.351	0.503	6.351	0.503	6.351	0.975	51.889	0.854	-0.652	-6.414	0.975	0.975
6	0.514	5.814	0.593	6.708	0.983	41.267	0.941	0.643	3.138	0.321	1.569	0.321	1.569	0.989	115.333	0.909	-0.302	-5.657	0.989	0.989
7	0.688	7.603	0.551	3.411	0.956	29.000	0.951	0.792	15.556	0.454	8.485	0.454	8.485	1.000	45.000	0.730	-0.329	-6.000	1.000	1.000
8	0.797	7.603	0.516	4.919	0.927	6.364	0.733	0.827	13.000	0.445	5.000	0.445	5.000	0.984	81.000	0.446	-0.318	-5.000	0.984	0.984
9	0.444	2.887	0.355	1.706	0.912	2.802	0.359	0.869	3.545	0.051	0.209	0.051	0.209	0.760	4.217	0.927	-0.051	-0.209	0.760	0.760
10	0.619	19.000	0.554	17.000	0.996	313.000	0.994	0.682	14.142	0.477	9.899	0.477	9.899	0.991	142.000	0.862	-0.546	-11.314	0.991	0.991
11	0.921	23.000	0.361	9.000	0.994	206.333	0.992	0.263	4.000	0.263	4.000	0.263	4.000	0.983	76.000	0.976	-0.919	-14.000	0.983	0.983
12	0.839	14.434	0.436	7.506	0.986	97.222	0.999	0.811	14.142	0.406	7.071	0.406	7.071	0.987	100.000	0.906	-0.406	-7.071	0.987	0.987
13	0.730	2.252	0.043	0.132	0.986	1.842	0.505	0.546	2.357	0.436	1.886	0.436	1.886	0.984	83.000	0.892	-0.546	-2.357	0.984	0.984
14	0.704	1.100	0.424	0.007	0.986	0.005	1.000	0.617	9.815	0.472	7.506	0.472	7.506	0.984	83.000	0.892	-0.472	-9.815	0.984	0.984
15	0.754	3.710	0.045	-0.218	0.986	0.005	1.000	0.617	9.815	0.472	7.506	0.472	7.506	0.984	83.000	0.892	-0.472	-9.815	0.984	0.984
16	0.285	2.887	0.295	2.887	0.958	30.556	0.938	0.177	8.816	0.158	2.449	0.158	2.449	0.973	5.778	0.751	-0.177	-2.449	0.973	0.973
17	0.285	2.887	0.295	2.887	0.958	30.556	0.938	0.177	8.816	0.158	2.449	0.158	2.449	0.973	5.778	0.751	-0.177	-2.449	0.973	0.973
18	0.684	2.646	0.475	1.800	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
19	0.861	8.165	0.430	-0.062	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
20	0.000	0.000	0.000	0.000	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
21	0.218	1.155	0.218	1.155	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
22	0.430	0.471	0.085	0.943	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
23	0.430	1.091	0.085	0.943	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
24	0.739	3.402	0.266	0.507	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
25	0.676	3.266	0.507	2.449	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
26	0.397	0.980	-0.397	-0.980	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
27	0.459	5.657	0.344	4.243	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
28	0.813	3.317	0.000	0.000	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
29	0.813	3.317	0.000	0.000	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
30	0.756	2.558	0.252	-0.853	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
31	0.625	7.071	0.125	1.414	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
32	0.535	1.633	0.000	0.000	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
33	0.712	2.400	0.194	0.655	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
34	0.813	6.351	0.000	-0.074	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
35	0.209	0.471	0.000	0.000	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
36	0.853	8.663	0.408	4.158	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
37	0.730	2.252	0.043	0.132	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
38	0.707	3.400	0.424	0.900	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
39	0.733	3.771	0.092	-0.471	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
40	0.452	2.449	-0.302	-1.633	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
41	0.547	2.324	-0.182	-0.775	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
42	0.837	4.914	-0.064	-0.378	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
43	0.438	1.732	-0.146	-0.577	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
44	0.855	7.506	-0.066	-0.471	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
45	0.560	3.402	-0.194	-0.471	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
46	0.562	4.000	-0.498	-3.402	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
47	0.667	4.914	0.000	0.000	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
48	0.719	4.914	-0.058	-0.277	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
49	0.801	3.051	0.472	6.480	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
50	0.801	3.051	0.472	6.480	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
51	0.801	3.051	0.472	6.480	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
52	0.709	8.497	0.634	7.603	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933
53	0.500	3.162	0.700	4.427	0.956	28.667	0.966	0.000	0.000	0.000	0.000	0.000	0.000	0.933	6.667	0.305	0.000	0.000	0.933	0.933

$F > 6.98 = p < .05$; $t > 2.65 = p < .05$; $R^2 > .830 = p > .05$; Reliability $> .552 = p < .05$

APPENDIX H, page 2
Study 3, Part 1 – Individual Level Results

Person	Conjoint Analysis 1										Conjoint Analysis 2									
	β Value	t-statistic	p Rank	t-statistic	R ²	F-Statistic	Reliability	p Value	t-statistic	p Rank	t-statistic	p Rank	t-statistic	p Rank	t-statistic	p Rank	t-statistic	p Rank	t-statistic	p Rank
64	0.516	4.619	0.000	-0.516	0.950	25.333	0.909	0.598	5.667	0.387	3.667	0.000	-0.669	0.500	0.613	0.535	5.000	0.000	0.991	0.000
65	0.662	3.400	0.000	0.530	1.000	4.500	1.000	0.199	4.000	0.465	3.667	0.000	0.863	0.000	0.863	0.000	0.863	0.000	0.863	0.000
66	0.617	8.000	0.000	-0.463	0.900	54.667	0.967	0.556	5.667	0.425	3.667	0.000	-0.579	0.500	0.946	0.000	0.946	0.000	0.946	0.000
67	0.673	1.000	0.318	-0.523	1.000	10.000	1.000	0.523	6.000	0.523	4.000	0.000	-0.673	0.000	1.000	0.000	1.000	0.000	1.000	0.000
68	0.643	12.728	0.000	-0.571	0.990	129.333	0.993	0.546	13.000	0.630	15.000	0.000	-0.417	0.500	0.993	0.000	0.993	0.000	0.993	0.000
69	0.702	7.506	0.000	-0.486	0.965	36.778	0.999	0.730	9.899	0.521	7.071	0.000	-0.743	0.000	2.600	0.000	2.600	0.000	2.600	0.000
70	0.710	11.314	0.000	-0.444	0.984	83.333	0.999	0.557	4.000	0.371	3.000	0.000	-0.453	0.500	0.995	0.000	0.995	0.000	0.995	0.000
71	0.702	21.000	0.000	-0.501	0.996	297.000	0.993	0.662	19.000	0.593	17.000	0.000	-0.368	0.500	0.993	0.000	0.993	0.000	0.993	0.000
72	0.300	2.111	0.034	-0.644	0.919	15.121	0.969	0.695	17.000	0.613	15.000	0.000	-0.811	0.000	0.991	0.000	0.991	0.000	0.991	0.000
73	0.621	7.000	0.000	-0.444	0.969	41.000	0.955	0.239	5.000	0.525	11.000	0.000	0.809	0.000	0.816	0.000	0.816	0.000	0.816	0.000
74	0.152	0.632	0.523	-0.610	0.976	4.400	0.901	0.000	0.000	0.461	7.000	0.000	0.855	0.000	0.855	0.000	0.855	0.000	0.855	0.000
75	0.126	0.632	0.523	-0.504	0.984	7.067	0.995	0.197	3.000	0.405	7.000	0.000	0.729	0.000	0.957	0.000	0.957	0.000	0.957	0.000
76	0.277	1.291	0.200	-0.608	0.817	5.933	0.808	0.292	2.828	0.583	5.657	0.000	0.701	0.000	0.957	0.000	0.957	0.000	0.957	0.000
77	0.292	0.943	0.343	-0.583	0.817	5.933	0.808	0.292	2.828	0.583	5.657	0.000	0.701	0.000	0.957	0.000	0.957	0.000	0.957	0.000
78	0.338	1.633	0.106	-0.507	0.929	6.444	0.945	-0.086	-1.000	0.775	9.000	0.000	0.602	0.000	0.970	0.000	0.970	0.000	0.970	0.000
79	0.209	1.000	0.318	-0.628	0.826	6.333	0.764	-0.144	-0.816	0.722	4.082	0.000	0.577	0.000	0.875	0.000	0.875	0.000	0.875	0.000
80	0.077	0.229	0.826	-0.232	0.988	0.545	1.596	-0.092	-0.577	0.456	2.867	0.000	0.825	0.000	0.899	0.000	0.899	0.000	0.899	0.000
81	0.237	0.853	0.400	-0.583	0.872	9.111	0.770	-0.066	-0.378	0.592	3.402	0.000	0.724	0.000	0.879	0.000	0.879	0.000	0.879	0.000
82	0.244	2.828	0.000	-0.611	0.970	43.333	0.981	0.227	1.342	0.378	2.236	0.000	0.904	0.000	0.942	0.000	0.942	0.000	0.942	0.000
83	0.461	4.041	0.000	-0.461	0.948	24.333	0.905	0.289	2.000	0.289	2.000	0.000	0.866	0.000	0.917	0.000	0.917	0.000	0.917	0.000
84	0.280	1.633	0.106	-0.560	0.882	10.000	0.918	0.107	0.577	0.536	2.887	0.000	0.750	0.000	0.862	0.000	0.862	0.000	0.862	0.000
85	0.180	0.632	0.523	-0.359	0.977	2.800	0.900	0.081	1.000	0.407	4.000	0.000	0.895	0.000	0.974	0.000	0.974	0.000	0.974	0.000
86	0.407	2.236	0.023	-0.407	0.967	8.733	0.906	0.000	0.000	0.387	4.243	0.000	0.904	0.000	0.967	0.000	0.967	0.000	0.967	0.000
87	0.642	2.333	0.023	-0.458	0.967	8.733	0.906	0.000	0.000	0.387	4.243	0.000	0.904	0.000	0.967	0.000	0.967	0.000	0.967	0.000
88	0.667	6.532	0.000	-0.417	0.982	30.667	0.930	0.712	2.558	0.356	1.279	0.000	-0.237	0.500	0.890	0.000	0.890	0.000	0.890	0.000
89	0.209	1.000	0.318	-0.375	0.986	6.333	0.906	0.084	0.570	0.570	2.111	0.000	-0.244	0.500	0.709	0.000	0.709	0.000	0.709	0.000
90	0.716	6.708	0.000	-0.433	0.937	19.963	0.906	0.664	4.041	0.475	2.887	0.000	-0.475	0.000	0.892	0.000	0.892	0.000	0.892	0.000
91	0.546	2.357	0.023	-0.375	0.986	6.333	0.906	0.084	0.570	0.570	2.111	0.000	-0.475	0.000	0.892	0.000	0.892	0.000	0.892	0.000
92	0.582	2.496	0.012	-0.323	0.987	7.950	0.949	0.825	3.402	0.275	1.134	0.000	-0.378	0.500	0.765	0.000	0.765	0.000	0.765	0.000
93	0.696	5.060	0.000	-0.261	0.987	16.267	0.977	0.905	6.364	0.302	2.121	0.000	-0.261	0.500	0.919	0.000	0.919	0.000	0.919	0.000
94	0.678	4.427	0.000	-0.261	0.987	16.267	0.977	0.905	6.364	0.302	2.121	0.000	-0.261	0.500	0.919	0.000	0.919	0.000	0.919	0.000
95	0.732	2.183	0.034	-0.232	0.928	17.222	0.968	0.768	4.020	0.329	7.100	0.000	-0.549	0.000	0.983	0.000	0.983	0.000	0.983	0.000
96	0.851	6.351	0.000	-0.081	0.950	16.272	0.952	0.803	2.828	0.302	1.414	0.000	-0.603	0.000	1.000	0.000	1.000	0.000	1.000	0.000
97	0.813	3.317	0.000	-0.222	0.905	7.600	0.900	0.825	3.402	0.275	1.134	0.000	-0.103	0.500	0.944	0.000	0.944	0.000	0.944	0.000
98	0.676	2.138	0.034	-0.338	0.969	6.000	0.932	0.831	2.887	0.356	3.000	0.000	-0.356	0.000	0.981	0.000	0.981	0.000	0.981	0.000
99	0.732	2.324	0.023	-0.244	0.975	6.000	0.932	0.831	2.887	0.356	3.000	0.000	-0.356	0.000	0.981	0.000	0.981	0.000	0.981	0.000
100	0.732	2.324	0.023	-0.244	0.975	6.000	0.932	0.831	2.887	0.356	3.000	0.000	-0.356	0.000	0.981	0.000	0.981	0.000	0.981	0.000
101	0.626	1.732	0.089	-0.209	0.977	4.778	0.968	0.809	4.899	0.405	2.449	0.000	-1.633	0.000	0.891	0.000	0.891	0.000	0.891	0.000
102	0.802	2.828	0.000	-0.134	0.471	0.679	0.638	0.809	4.899	0.405	2.449	0.000	-1.633	0.000	0.891	0.000	0.891	0.000	0.891	0.000
103	0.620	1.000	0.318	-0.482	1.000	2.200	1.000	0.886	7.348	0.534	5.715	0.000	-0.457	0.500	0.965	0.000	0.965	0.000	0.965	0.000
104	0.451	1.715	0.089	-0.721	0.724	3.490	0.779	0.566	1.938	0.131	0.447	0.000	-1.938	0.000	0.658	0.000	0.658	0.000	0.658	0.000

$F > 6.98 = p < .05$; $t > 2.65 = p < .05$; $R^2 > .830 = p > .05$; Reliability $> .552 = p < .05$

APPENDIX H, page 3
Study 3, Part 1 – Individual Level Results

Person	Conjoint Analysis 1										Conjoint Analysis 2									
	β Value	t-statistic	β Rarity	t-statistic	β Immutability	t-statistic	F-Statistic	Reliability	R^2	F-Statistic	β Value	t-statistic	β Rarity	t-statistic	β Immutability	t-statistic	R^2	F-Statistic	Reliability	
106	0.693	5.270	0.474	3.606	-0.474	-3.606	0.931	17.923	0.938	0.686	7.348	0.534	0.534	0.457	-4.899	0.965	36.889	0.765		
107	0.571	8.000	0.571	8.000	-0.571	-8.000	0.980	64.000	0.973	0.709	8.487	0.485	0.485	-0.485	-5.814	0.972	46.800	0.798		
108	0.968	7.071	0.968	7.071	-0.968	-7.071	0.984	36.000	0.968	0.700	3.000	0.700	0.700	-0.140	-2.000	1.000	35.870	0.778		
109	0.498	1.859	0.045	0.169	-0.680	-2.535	0.713	3.305	0.892	0.568	1.938	0.131	0.131	-0.568	-1.938	0.658	2.570	0.422		
110	0.759	5.019	0.495	3.273	-0.297	-1.964	0.909	13.254	0.835	0.850	5.729	0.513	0.513	-0.513	-4.523	0.949	24.578	0.711		
111	0.710	15.556	0.581	12.728	-0.387	-8.485	0.992	158.667	0.983	0.395	1.414	0.712	0.712	-0.158	-0.568	0.688	2.933	0.917		
112	0.547	5.715	0.781	8.165	-0.234	-2.449	0.963	35.111	0.940	0.774	8.165	0.387	0.387	-0.464	-4.899	0.964	35.778	0.888		
113	0.772	5.992	0.514	3.795	-0.257	-1.897	0.926	16.800	0.913	0.475	1.890	0.664	0.664	-0.285	-1.134	0.748	3.952	0.635		
114	0.879	4.914	0.574	4.158	-0.365	-2.646	0.924	16.143	0.855	0.651	3.538	0.651	0.651	-0.130	-0.707	0.864	8.500	0.411		
115	0.000	0.000	0.500	1.414	0.500	1.414	0.500	1.333	0.000	0.119	0.258	0.119	0.119	-0.258	-1.134	0.964	83.353	0.365		
116	0.752	5.715	-0.344	-3.266	0.889	6.532	0.958	28.667	0.934	0.355	5.957	0.268	0.268	-0.887	-14.142	0.984	83.353	0.765		
117	0.810	11.314	0.886	12.728	-0.381	-7.071	0.988	113.333	0.993	0.682	19.000	0.593	0.593	-0.463	-3.357	1.000	273.000	0.868		
118	0.836	12.728	0.836	12.728	-0.424	-8.485	0.990	132.000	0.992	0.309	2.000	0.772	0.772	-0.463	-3.357	1.000	28.430	0.824		
119	0.658	5.060	0.575	4.427	-0.411	-3.162	0.932	18.400	0.889	0.628	3.873	0.542	0.542	-0.459	-3.357	1.000	28.430	0.812		
120	0.864	8.660	0.684	8.660	-0.064	-0.577	0.911	27.741	0.924	0.000	0.000	0.338	0.338	0.845	4.082	0.829	6.444	0.575		
121	0.854	8.660	0.000	0.000	0.135	0.471	0.873	2.741	0.727	-0.065	-1.000	0.194	0.194	0.970	15.000	0.983	78.333	0.530		
122	0.609	2.928	0.000	0.000	0.220	0.869	0.831	6.571	0.946	0.000	0.000	0.270	0.270	0.834	9.899	0.964	35.333	0.466		
123	0.768	3.742	0.439	1.897	-0.439	-2.138	0.980	8.222	0.763	0.000	0.000	0.209	0.209	0.944	3.266	0.739	3.778	0.542		
124	0.915	4.899	0.000	0.000	0.152	0.816	0.980	8.222	0.763	0.000	0.000	0.270	0.270	0.944	3.266	0.739	3.778	0.542		
125	0.577	1.897	0.365	-1.265	-0.365	-1.265	0.630	2.267	0.561	0.378	1.342	0.378	0.378	0.630	2.236	0.683	2.867	0.802		
126	0.816	3.266	0.304	0.816	-0.204	-0.816	0.750	4.000	0.671	0.452	2.449	0.302	0.302	0.754	4.082	0.864	8.444	0.802		
127	0.770	3.266	0.635	2.887	-0.192	-0.816	0.778	4.887	0.690	0.280	2.828	0.280	0.280	0.911	1.100	1.000	48.230	0.292		
128	0.813	6.351	0.370	2.887	-0.370	-2.887	0.824	4.887	0.904	0.077	0.447	0.387	0.387	0.851	4.819	0.880	9.800	0.431		
129	0.944	5.715	0.000	0.000	0.063	0.438	0.873	2.741	0.727	-0.065	-1.000	0.194	0.194	0.970	15.000	0.983	78.333	0.530		
130	0.839	6.708	0.188	-1.342	0.000	0.000	0.861	10.869	0.844	0.079	0.378	0.000	0.000	0.756	3.402	0.765	4.333	0.628		
131	0.729	2.887	-0.146	-0.577	0.323	1.308	0.816	5.909	0.844	0.079	0.378	0.000	0.000	0.756	3.402	0.765	4.333	0.628		
132	0.712	3.317	0.453	2.111	0.323	1.308	0.816	5.909	0.844	0.079	0.378	0.000	0.000	0.756	3.402	0.765	4.333	0.628		
133	0.712	3.317	0.453	2.111	0.323	1.308	0.816	5.909	0.844	0.079	0.378	0.000	0.000	0.756	3.402	0.765	4.333	0.628		
134	0.842	2.333	0.275	1.000	0.086	0.458	0.687	3.074	0.529	0.458	2.828	0.298	0.298	0.887	5.166	0.883	10.111	0.537		
135	0.775	2.496	0.086	0.277	0.086	0.277	0.615	2.744	0.548	0.251	1.000	0.135	0.135	0.920	11.000	0.978	59.667	0.499		
136	0.555	1.941	0.338	-0.832	0.555	1.941	0.600	3.778	0.808	0.135	1.000	0.135	0.135	0.920	11.000	0.978	59.667	0.499		
137	0.876	2.138	0.069	0.169	0.069	0.169	0.600	3.778	0.808	0.135	1.000	0.135	0.135	0.920	11.000	0.978	59.667	0.499		
138	0.812	4.243	0.612	4.243	0.408	2.828	0.917	14.667	0.927	0.153	3.000	0.251	0.251	0.971	13.000	0.978	59.667	0.499		
139	0.834	3.266	0.209	0.816	0.000	0.000	0.739	3.778	0.548	0.251	1.000	0.251	0.251	0.971	13.000	0.978	59.667	0.499		
140	0.775	3.207	0.129	0.535	0.387	1.604	0.767	4.381	0.538	0.286	3.000	0.298	0.298	0.887	9.000	0.981	33.000	0.584		
141	0.841	3.806	0.194	0.832	0.194	0.832	0.782	4.795	0.748	-0.086	-1.000	0.258	0.258	0.947	11.000	0.970	43.667	0.592		
142	0.612	1.604	0.000	0.000	0.204	0.535	0.417	0.952	-0.302	0.626	3.000	0.626	0.626	0.209	0.365	0.650	2.267	0.826		
143	0.408	1.155	0.408	1.155	-0.408	-1.155	0.500	1.333	0.000	0.385	1.265	0.577	0.577	-0.365	-3.333	0.938	6.333	0.793		
144	0.493	2.236	0.890	3.130	-0.296	-1.342	0.808	5.533	0.775	0.563	2.236	0.563	0.563	-0.365	-3.333	0.938	6.333	0.793		
145	0.565	2.333	0.585	2.333	-0.251	-1.000	0.748	3.983	0.775	0.563	2.236	0.563	0.563	-0.365	-3.333	0.938	6.333	0.793		
146	0.743	2.300	0.557	0.400	-0.371	-1.250	1.000	2.100	1.000	0.387	0.928	0.387	0.387	0.928	0.928	0.000	0.000	0.884	0.833	
147	0.746	4.427	0.533	3.162	-0.213	-1.265	0.886	10.400	0.801	0.628	1.732	0.209	0.209	0.577	3.000	0.981	33.000	0.584		
148	0.659	8.485	0.659	8.485	-0.329	-4.243	0.978	54.000	0.952	0.707	2.828	0.354	0.354	0.354	0.354	0.981	33.000	0.584		
149	0.654	7.000	0.654	7.000	-0.285	-3.000	0.964	35.667	0.933	0.674	2.236	0.405	0.405	0.342	0.342	0.981	33.000	0.584		
150	0.814	2.065	0.477	1.006	-0.205	-0.888	0.647	2.439	0.358	0.378	1.342	0.378	0.378	0.342	0.342	0.981	33.000	0.584		
151	-0.160	-0.378	0.160	-0.378	0.480	1.134	0.282	0.524	-0.302	0.128	1.000	0.882	0.882	0.378	0.378	0.981	33.000	0.584		
152	0.438	1.134	0.146	0.378	0.438	1.134	0.404	0.905	0.522	0.258	1.000	0.944	0.944	-0.086	-1.000	0.970	43.667	0.925		
153	0.302	0.816	0.603	1.633	0.000	0.000	0.455	1.111	0.816	0.539	1.342	0.180	0.180	0.355	0.355	0.970	43.667	0.925		
154	0.302	0.816	0.603	1.633	0.000	0.000	0.455	1.111	0.816	0.539	1.342	0.180	0.180	0.355	0.355	0.970	43.667	0.925		
155	0.626	3.000	0.626	3.000	0.000	0.000	0.828	6.333	0.184	0.593	1.890	-0.356	-0.356	0.356	0.356	0.970	43.667	0.925		
156	0.459	1.633	0.688	2.449	0.000	0.000	0.684	2.889	0.471	0.729	2.887	-0.146	-0.146	0.407	0.407	0.970	43.667	0.925		
157	0.577	2.121	0.577	2.121	0.192	0.707	0.704	3.167	0.508	0.732	2.714	0.407	0.407	0.508	0.508	0.970	43.667	0.925		
158	0.876	3.266	0.507	2.449	-0.338	-1.633	0.829	6.444	0.707	0.333	1.155	0.667	0.667	0.333	0.333	0.970	43.667	0.925		
159	0.516	1.633	0.516	1.633	-0.258	-0.816	0.600	2.000	0.316	0.338	1.000	0.593	0.593	0.338	0.338	0.970	43.667	0.925		
160	0.480	1.134	0.160	0.378	0.160	0.378	0.282	0.524	-0.428	0.358	1.000	0.593	0.593	0.338	0.338	0.970	43.667	0.925		
161	0.718	4.041	0.513	2.887	-0.308	-1.732	0.874	9.222	0.905	0.753	3.402	0.418	0.418	0.251	0.251	1.000	48.230	0.292		

$F > 6.98 = p < .05$; $t > 2.65 = p < .05$; $R^2 > .830 = p > .05$; Reliability $> .552 = p < .05$

APPENDIX H, page 4 Study 3, Part 1 – Individual Level Results

Person	Coefficient Analysis 1										Coefficient Analysis 2									
	β Value	t-statistic	β Reliability	F-Statistic	R ²	t-statistic	β Reliability	F-Statistic	R ²	t-statistic	β Reliability	F-Statistic	R ²	t-statistic	β Reliability	F-Statistic	R ²	t-statistic	β Reliability	
163	0.556	1.677	0.354	1.067	-1.067	0.560	1.699	0.528	0.664	5.000	0.398	3.000	0.930	-4.333	0.000	0.000	0.930	17.593	0.635	
164	0.563	1.890	0.563	1.890	-0.378	0.846	2.429	0.816	0.816	4.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.333	0.706	
165	0.556	1.718	0.455	1.406	-0.253	0.581	1.846	0.203	0.664	4.427	0.380	2.530	0.910	-3.795	0.910	13.467	0.910	13.467	0.635	
166	0.400	1.109	0.400	1.109	-0.400	0.480	1.231	0.044	0.689	6.532	0.398	6.532	0.956	-5.715	0.956	28.667	0.956	28.667	0.635	
167	0.686	12.728	0.610	11.314	-7.071	0.988	113.333	0.993	0.591	6.532	0.591	6.532	0.951	-5.715	0.967	39.333	0.951	39.333	0.933	
168	0.556	1.677	0.354	1.067	-0.354	0.560	1.698	0.528	0.664	5.000	0.398	3.000	0.930	-4.333	0.000	0.000	0.930	17.593	0.635	
169	0.531	6.708	0.814	10.288	-0.177	0.238	0.975	51.933	0.983	17.000	0.613	15.000	0.983	-9.000	0.993	198.333	0.993	198.333	0.072	
170	0.563	1.890	0.563	1.890	-0.113	0.378	0.646	2.429	0.816	4.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.333	0.706	
171	0.763	15.556	0.485	9.899	-0.416	0.485	0.990	137.333	0.992	4.919	0.594	4.919	0.942	-4.025	0.942	21.533	0.942	21.533	0.912	
172	0.507	2.746	0.724	3.922	-0.289	0.569	8.482	0.817	0.524	4.899	0.899	6.532	0.956	-4.377	0.956	21.778	0.956	21.778	0.848	
173	0.636	14.142	0.573	12.728	-0.609	-11.314	0.982	163.333	0.995	15.000	0.598	17.000	0.985	-17.000	0.995	267.667	0.985	267.667	0.864	
174	0.662	10.970	0.523	8.660	-0.523	-8.660	0.985	90.111	0.975	4.427	0.610	5.000	0.942	-4.427	0.942	21.600	0.942	21.600	0.805	
175	0.517	7.000	0.665	9.000	-0.517	-7.000	0.978	59.667	0.968	5.128	0.790	5.128	0.967	-3.130	0.967	38.000	0.967	38.000	0.957	
176	0.743	2.469	0.693	3.009	-0.279	0.926	0.638	2.349	0.795	5.814	0.776	8.497	0.967	-3.130	0.967	38.000	0.967	38.000	0.903	
177	0.643	6.532	0.582	5.715	-0.482	-4.899	0.981	33.111	0.942	0.531	7.603	0.451	4.025	-1.342	0.950	25.267	0.950	25.267	0.716	
178	0.722	3.162	0.433	1.897	-0.289	-1.265	0.792	5.067	0.619	0.000	0.000	0.000	0.000	-0.150	0.000	0.000	0.000	0.000	0.716	
179	0.356	3.000	0.356	3.000	-0.632	-7.000	0.944	22.333	0.985	0.209	3.000	0.348	5.000	0.904	0.000	0.000	0.904	19.000	0.772	
180	0.316	2.000	0.632	4.000	-0.632	-4.000	0.900	12.000	0.851	0.074	0.577	0.577	0.000	0.813	0.000	0.000	0.813	19.000	0.772	
181	0.493	5.000	0.690	7.000	-0.493	-5.000	0.981	33.000	0.943	0.000	0.000	0.000	0.000	0.875	0.000	0.000	0.875	30.000	0.632	
182	0.338	1.633	0.678	3.266	-0.507	-2.449	0.829	6.444	0.675	0.000	0.000	0.000	0.000	0.882	0.000	0.000	0.882	30.000	0.772	
183	0.358	1.732	0.831	4.041	-0.119	-0.577	0.831	6.556	0.739	1.126	1.000	0.378	3.000	0.875	0.000	0.000	0.875	19.667	0.880	
184	0.405	1.342	0.674	2.336	0.135	0.447	0.636	3.333	0.302	0.125	0.632	0.250	0.632	0.843	0.000	0.000	0.843	7.200	0.803	
185	0.775	3.000	0.258	1.000	0.258	1.000	0.733	3.667	0.577	0.000	0.000	0.236	2.000	0.943	0.000	0.000	0.943	22.667	0.812	
186	0.000	0.000	0.000	0.000	-0.378	-1.414	0.714	3.333	0.522	0.068	0.447	0.341	2.236	0.897	0.000	0.000	0.897	13.000	0.891	
187	0.209	1.000	0.626	3.000	-0.626	-3.000	0.826	6.333	0.730	0.341	0.539	5.657	0.915	8.485	0.964	35.333	0.964	35.333	0.889	
188	-0.160	-0.447	0.480	1.342	-0.480	-1.342	0.487	1.267	0.287	1.414	0.305	2.828	0.915	8.485	0.953	27.333	0.953	27.333	0.824	
189	0.250	0.632	0.500	1.265	-0.250	-0.632	0.375	0.800	0.000	0.832	0.074	0.277	0.813	3.051	0.716	3.359	0.716	3.359	0.817	
190	-0.160	-0.577	0.801	2.867	-0.160	-0.577	0.801	2.867	0.905	1.414	0.305	2.828	0.915	8.485	0.953	27.333	0.953	27.333	0.858	
191	-0.135	-1.000	0.944	7.000	-0.135	-1.000	0.927	17.000	0.905	1.414	0.305	2.828	0.915	8.485	0.953	27.333	0.953	27.333	0.858	
192	0.128	0.577	0.882	4.041	-0.128	-0.577	0.882	4.041	0.674	0.577	0.577	0.577	0.000	0.813	0.000	0.000	0.813	14.667	0.824	
193	0.603	2.828	0.603	2.828	-0.302	-1.414	0.818	6.000	0.927	2.000	0.289	2.000	0.889	6.000	0.917	14.667	0.917	14.667	0.821	
194	0.302	1.414	0.603	2.828	-0.603	-2.828	0.818	6.000	0.636	0.213	1.342	0.496	3.130	0.780	0.889	11.933	0.889	11.933	0.821	
195	0.516	1.633	0.516	1.633	-0.250	-0.632	0.375	0.800	0.316	0.070	0.577	0.348	2.887	0.904	0.942	21.667	0.942	21.667	0.813	
196	0.500	1.265	0.250	0.632	-0.250	-0.632	0.375	0.800	-0.208	-0.066	-0.577	0.461	4.041	0.855	0.848	24.333	0.848	24.333	0.805	
197	0.447	1.414	0.447	1.414	-0.447	-1.414	0.600	2.000	0.577	0.071	1.000	0.354	5.000	0.922	13.000	0.980	65.000	0.872		
198	0.135	1.000	0.674	5.000	-0.674	-5.000	0.927	17.000	0.977	0.000	0.000	0.316	1.200	0.949	1.200	1.000	28.220	0.889		
199	0.507	2.449	0.676	3.266	-0.338	-1.633	0.829	6.444	0.945	0.507	2.449	0.676	3.266	-0.338	-0.338	6.444	0.444	6.444	0.887	
200	0.542	2.333	0.696	3.000	0.077	0.333	0.784	4.852	0.617	0.308	1.732	0.513	2.333	-0.103	-0.333	0.821	2.185	0.786	0.887	
201	0.475	1.890	0.684	2.646	-0.285	-1.134	0.748	3.952	0.863	0.308	1.732	0.513	2.333	-0.103	-0.333	0.821	2.185	0.786	0.887	
202	0.555	3.130	0.714	4.025	-0.238	-1.342	0.874	9.267	0.863	0.680	4.025	0.529	3.130	-0.378	-0.238	0.886	10.333	0.921	0.921	
203	0.632	4.000	0.632	4.000	-0.316	-2.000	0.900	12.000	0.986	0.555	4.000	0.555	4.000	-0.555	-0.555	4.000	0.923	16.000	0.937	
204	0.576	2.666	0.507	2.449	-0.338	-1.633	0.829	6.444	0.868	0.555	2.666	0.555	2.666	-0.180	-0.180	0.756	4.137	0.884	0.884	
205	0.678	4.000	0.378	2.000	-0.378	-2.000	0.857	6.519	0.748	0.459	2.828	0.750	2.828	-0.475	-0.475	0.895	11.333	0.773	0.773	
206	0.632	2.666	0.474	2.449	-0.474	-2.449	0.850	6.850	0.850	0.801	0.500	2.828	0.750	-0.204	-0.204	0.895	11.333	0.773	0.773	
207	0.542	2.646	0.696	3.402	-0.232	-1.134	0.852	6.619	0.801	0.500	2.828	0.750	2.828	-0.204	-0.204	0.895	11.333	0.773	0.773	
208	0.668	7.071	0.555	5.657	-0.416	-4.243	0.964	83.667	0.979	0.316	2.000	0.632	4.000	-0.632	-0.632	4.000	0.960	12.000	0.812	
209	0.693	11.000	0.438	7.000	-0.564	-9.000	0.984	83.667	0.979	0.316	2.000	0.632	4.000	-0.632	-0.632	4.000	0.960	12.000	0.812	
210	0.689	11.000	0.438	7.000	-0.564	-9.000	0.984	83.667	0.979	0.316	2.000	0.632	4.000	-0.632	-0.632	4.000	0.960	12.000	0.812	
211	0.753	3.402	0.418	1.890	-0.251	-1.134	0.804	5.476	0.827	0.430	5.000	0.430	5.000	-0.775	-0.775	0.970	43.667	0.904	0.904	
212	0.555	3.130	0.585	7.000	-0.251	-1.134	0.804	5.476	0.827	0.430	5.000	0.430	5.000	-0.775	-0.775	0.970	43.667	0.904	0.904	
213	0.555	3.130	0.585	7.000	-0.251	-1.134	0.804	5.476	0.827	0.430	5.000	0.430	5.000	-0.775	-0.775	0.970	43.667	0.904	0.904	
214	0.224	1.414	0.894	5.657	-0.224	-1.414	0.900	12.000	0.916	0.626	2.183	0.487	1.998	-0.209	-0.209	0.928	17.222	0.927	0.927	
215	0.224	1.414	0.894	5.657	-0.224	-1.414	0.900	12.000	0.916	0.626	2.183	0.487	1.998	-0.209	-0.209	0.928	17.222	0.927	0.927	
216	0.887	9.000	0.298	3.000	-0.298	-3.000	0.961	33.000	0.943	0.602	4.041	0.430	2.887	-0.602	-0.602	4.041	0.911	13.667	0.965	
217	0.814	9.000	0.614	9.000	-0.477	-7.000	0.981	70.333	0.977	0.791										

$F > 6.98 = p < .05$; $t > 2.65 = p < .05$; $R^2 > .830 = p > .05$; Reliability $> .552 = p < .05$

APPENDIX I Study 3, Part 2 (Pre-Feedback) – Individual level Results

Conjoint Analysis 3 - Part 1 of Study 3																				
Person	β Value	t-ratio	β Rarity	t-ratio	β Imitability	t-ratio	β Limits	t-ratio	β Relatedness	t-ratio	β Rel'Ratio	t-ratio	β Rel'Value	t-ratio	β Rel'Limits	t-ratio	R ²	F-Statistic	Reliability	
1	0.366	2.291	0.173	1.085	-0.558	-4.945	-0.096	-0.603	0.385	1.705	-0.033	-0.171	-0.033	-0.171	0.233	1.194	0.707	6.939	0.757	
2	0.033	0.195	0.234	1.364	-0.502	-4.133	0.033	0.195	0.067	0.276	0.000	0.000	0.290	1.378	0.348	1.653	0.960	5.599	0.855	
3	-0.167	-1.273	0.292	2.228	-0.375	-4.051	0.417	3.183	0.396	2.138	0.108	0.675	0.000	0.000	0.108	0.675	0.803	11.709	0.690	
4	0.370	2.576	0.175	1.220	-0.516	-5.081	-0.097	-0.678	0.389	1.917	-0.084	-0.479	0.051	0.288	0.287	1.630	0.763	9.253	0.758	
5	0.265	1.534	0.382	2.216	-0.250	-2.049	0.324	1.875	0.324	1.326	0.025	0.121	-0.025	-0.121	0.178	0.844	0.658	5.521	0.772	
6	0.372	3.406	0.521	4.769	-0.621	-8.029	0.124	1.135	0.074	0.482	0.000	0.000	-0.086	-0.642	0.215	1.606	0.863	18.049	0.854	
7	0.715	6.758	0.321	3.030	-0.086	-1.154	0.419	3.962	0.296	1.977	-0.064	-0.494	0.064	0.494	-0.064	-0.494	0.871	19.443	0.909	
8	0.395	2.713	0.152	1.044	-0.121	-1.181	0.334	2.296	0.456	2.214	0.105	0.590	0.210	1.181	-0.105	-0.590	0.756	8.930	0.730	
9	0.538	2.424	0.108	0.485	-0.081	-0.514	0.430	1.939	0.323	1.028	-0.419	-1.543	-0.233	-0.857	-0.047	-0.171	0.434	2.203	0.446	
10	0.591	8.015	0.318	4.316	-0.386	-7.412	0.500	6.782	0.477	4.578	0.079	0.872	-0.157	-1.744	-0.039	-0.436	0.938	43.125	0.927	
11	0.624	6.143	0.096	0.945	-0.288	-4.010	0.240	2.363	0.312	2.172	-0.042	-0.334	0.000	0.000	0.291	2.339	0.881	21.339	0.862	
12	0.399	8.972	0.399	8.972	-0.285	-9.063	0.399	8.972	0.342	5.438	0.099	1.813	0.099	1.813	0.099	1.813	0.977	123.625	0.976	
13	0.364	4.804	0.492	6.500	-0.471	-8.792	0.492	6.500	0.556	5.195	-0.037	-0.400	-0.148	-1.598	-0.037	-0.400	0.930	40.709	0.906	
14	0.493	4.059	0.441	3.632	-0.260	-3.021	0.649	5.341	0.234	1.359	0.000	0.000	-0.045	-0.302	-0.135	-0.908	0.830	14.056	0.773	
15	0.484	5.670	0.207	2.430	-0.634	-10.501	0.207	2.430	0.300	2.482	-0.060	-0.573	0.100	0.955	0.060	0.573	0.916	31.456	0.892	
16	0.432	2.493	0.270	1.558	-0.175	-1.432	0.324	1.870	0.108	0.441	0.117	0.551	0.070	0.331	0.164	0.771	0.655	5.450	0.789	
17	-0.050	-0.185	-0.050	-0.185	-0.248	-1.310	0.050	0.185	0.149	0.393	0.172	0.524	0.172	0.524	-0.086	-0.262	0.177	0.618	-0.086	
18	0.159	0.643	0.000	0.000	-0.357	-2.046	-0.079	-0.322	-0.040	-0.114	0.275	0.909	0.137	0.455	0.069	0.227	0.300	1.234	0.305	
19	0.113	0.440	-0.038	-0.147	-0.245	-1.349	-0.188	-0.734	-0.188	-0.519	0.229	0.727	0.098	0.311	0.424	1.349	0.242	0.916	0.373	
20	-0.041	-0.152	-0.041	-0.152	-0.268	-1.400	-0.041	-0.152	-0.329	-0.862	0.321	0.969	0.178	0.538	0.178	0.538	0.159	0.545	0.066	
21	-0.401	-2.145	-0.240	-1.287	-0.561	-4.246	-0.240	-1.287	-1.002	-3.791	0.416	1.820	0.625	2.730	0.486	2.123	0.599	4.290	0.695	
22	-0.308	-1.323	0.132	0.567	-0.418	-2.540	-0.132	-0.567	-0.396	-1.203	0.114	0.401	0.419	1.471	1.471	0.376	1.733	0.717	0.717	
23	-0.040	-0.166	0.120	0.499	-0.361	-2.119	-0.040	-0.166	0.080	0.235	0.070	0.235	0.209	0.706	0.209	0.706	0.331	1.420	0.671	
24	-0.078	-0.290	0.000	0.000	-0.137	-0.719	-0.078	-0.290	0.078	0.205	0.170	0.513	0.102	0.308	0.170	0.513	0.163	0.558	0.231	
25	-0.174	-0.640	0.174	0.640	-0.196	-1.018	-0.087	-0.320	-0.174	-0.452	-0.038	-0.113	0.339	1.018	0.263	0.791	0.151	0.511	0.248	
26	-0.169	-0.731	0.085	0.366	-0.423	-2.586	-0.085	-0.366	-0.507	-1.551	0.293	1.034	0.439	1.551	0.293	1.034	0.386	1.805	0.660	
27	-0.292	-1.211	-0.125	-0.519	-0.250	-1.468	0.125	0.519	-0.500	-1.468	0.361	1.224	0.578	1.958	0.261	0.734	0.332	1.430	0.638	
28	-0.250	-1.120	0.083	0.373	-0.230	-1.453	-0.083	-0.373	-0.417	-1.321	0.181	0.660	0.759	2.773	0.253	0.924	0.425	2.127	0.602	
29	-0.218	-1.013	0.073	0.338	-0.453	-2.983	-0.290	-1.350	-0.399	-1.313	0.283	1.074	0.471	1.790	0.346	1.313	0.469	2.535	0.596	
30	-0.044	-0.163	0.218	0.816	-0.261	-1.384	0.044	0.163	0.087	0.231	-0.226	-0.692	0.302	0.923	0.075	0.231	0.180	0.632	0.217	
31	-0.091	-0.373	0.091	0.373	-0.411	-2.372	0.091	0.373	0.274	0.791	-0.158	-0.527	0.237	0.791	0.000	0.000	0.309	1.285	0.276	
32	-0.233	-1.010	-0.047	-0.202	-0.349	-2.143	0.419	1.818	0.186	0.571	-0.040	-0.143	0.363	1.286	-0.121	-0.429	0.390	1.837	0.248	
33	-0.183	-0.900	-0.183	-0.900	-0.503	-3.501	0.366	1.801	-0.183	-0.637	0.475	1.910	0.317	1.273	-0.079	-0.318	0.526	3.192	0.641	
34	0.108	0.519	-0.036	-0.173	-0.558	-3.795	0.036	0.173	-0.144	-0.490	0.343	1.346	0.094	0.367	0.218	0.857	0.503	2.907	0.672	
35	0.122	0.487	0.041	0.162	-0.345	-1.953	0.041	0.162	-0.122	-0.345	0.106	0.345	0.176	0.574	0.246	0.804	0.281	1.122	0.408	
36	0.364	4.804	0.492	6.500	-0.471	-8.792	0.492	6.500	0.556	5.195	-0.037	-0.400	-0.148	-1.598	-0.037	-0.400	0.934	40.709	0.906	
37	0.493	4.059	0.441	3.632	-0.260	-3.021	0.649	5.341	0.234	1.359	0.000	0.000	-0.045	-0.302	-0.135	-0.906	0.830	14.056	0.773	
38	0.484	5.670	0.207	2.430	-0.634	-10.501	0.207	2.430	0.300	2.482	-0.060	-0.573	0.100	0.955	0.060	0.573	0.916	31.456	0.892	
39	0.329	2.222	0.197	1.333	-0.428	-4.084	0.000	0.000	-0.033	-0.157	0.114	0.628	0.114	0.628	0.513	2.828	0.748	8.526	0.897	
40	0.193	1.080	0.061	0.360	-0.457	-3.818	0.000	0.000	-0.244	-1.018	0.316	1.527	0.211	1.018	0.211	2.291	0.871	5.863	0.824	
41	0.314	1.988	-0.035	-0.221	-0.470	-3.818	0.000	0.000	-0.105	-0.469	0.272	1.406	0.091	0.469	0.513	2.655	0.714	7.171	0.774	
42	0.415	2.608	0.032	0.201	-0.399	-3.546	-0.032	-0.201	-0.160	-0.709	0.304	1.560	-0.028	-0.142	0.580	2.979	0.709	7.003	0.836	
43	0.319	2.028	0.064	0.406	-0.431	-3.871	0.064	0.406	-0.287	-1.290	0.304	1.577	0.028	0.143	0.580	3.011	0.715	7.214	0.742	
44	0.275	1.954	0.092	0.651	-0.428	-4.298	0.031	0.217	-0.306	-1.535	0.423	2.456	0.106	0.614	0.529	3.070	0.772	9.744	0.761	
45	0.254	1.811	-0.036	-0.259	-0.526	-5.306	0.181	1.294	-0.145	-0.732	0.346	2.013	0.157	0.915	0.346	2.013	0.774	9.843	0.735	

$F > 2.51 = p < .05$; $t > 2.10 = p < .05$; $R^2 > .503 = p > .05$; Reliability $> .554 = p < .05$

APPENDIX I, page 2
Study 3, Part 2 (Pre-Feedback) – Individual level Results

Conjoint Analysis 3 - Part 2 of Study 3																			
Person	β Value	t-ratio	β Rarity	t-ratio	β Inhabitability	t-ratio	β Limits	t-ratio	β Relatedness	t-ratio	β Rarity	t-ratio	β Rel'Value	t-ratio	β Rel'Limits	t-ratio	R ²	F-Statistic	Reliability
46	0.170	1.000	0.034	0.200	-0.390	-3.251	0.102	0.600	-0.203	-0.406	0.323	1.555	0.147	0.707	0.499	2.403	0.669	5.815	0.779
47	0.214	1.149	0.000	0.000	-0.338	-2.572	0.071	0.383	-0.107	-0.406	0.339	1.489	0.154	0.677	0.401	1.760	0.603	4.362	0.828
48	0.361	2.191	-0.033	-0.199	-0.344	-2.958	0.033	0.199	-0.230	-0.986	0.426	1.898	0.085	0.423	0.483	2.395	0.688	6.350	0.801
49	0.396	2.250	0.030	0.173	-0.304	-2.447	-0.030	-0.173	-0.244	-0.979	0.316	1.468	0.105	0.489	0.527	2.447	0.644	5.203	0.897
50	0.000	0.000	-0.136	-0.558	-0.453	-2.632	0.136	0.558	-0.407	-1.184	0.363	1.184	0.039	0.132	0.157	0.526	0.320	1.351	-0.093
51	0.218	1.797	0.437	3.595	-0.524	-6.100	0.612	5.032	0.437	2.542	-0.151	-1.017	-0.076	-0.508	-0.076	-0.508	0.830	14.052	0.781
52	0.353	2.500	0.353	2.500	-0.299	-2.991	0.299	2.115	0.360	1.904	0.188	1.088	0.141	0.816	-0.188	-1.088	0.771	9.660	0.889
53	0.284	1.668	0.336	1.972	-0.155	-1.287	0.697	4.095	-0.026	-0.107	0.313	1.501	-0.089	-0.429	-0.402	-1.930	0.667	5.750	0.451
54	0.127	0.992	0.255	1.983	-0.361	-3.973	0.594	4.628	0.403	2.220	-0.110	-0.701	0.037	0.234	0.110	0.701	0.810	12.285	0.780
55	0.283	2.571	-0.283	-2.571	0.748	9.609	0.324	2.938	0.384	2.467	-0.070	-0.519	-0.035	-0.260	-0.140	-1.039	0.860	17.731	0.837
56	0.496	4.217	0.451	3.834	-0.519	-6.235	0.135	1.150	0.293	1.762	-0.195	-1.355	0.156	1.084	0.000	0.000	0.841	15.165	0.814
57	0.487	4.281	0.360	3.164	-0.296	-3.685	0.614	5.397	0.466	2.895	0.147	1.053	-0.257	-1.842	-0.110	-0.790	0.851	16.445	0.819
58	0.176	1.193	0.428	2.897	-0.554	-5.302	-0.025	-0.170	-0.151	-0.723	-0.044	-0.241	0.349	1.928	0.306	1.687	0.749	8.560	0.731
59	0.536	3.414	0.281	1.789	-0.281	-2.529	0.383	2.439	0.306	1.380	0.221	1.150	-0.133	-0.690	-0.044	-0.230	0.717	7.277	0.573
60	0.273	2.142	0.334	2.618	-0.455	-5.049	0.334	2.618	0.152	0.842	0.210	1.346	0.053	0.337	0.105	0.673	0.813	12.520	0.776
61	0.492	2.541	0.211	1.089	-0.105	-0.770	0.211	1.089	-0.070	-0.257	0.223	0.941	0.020	0.086	0.223	0.941	0.559	3.791	0.586
62	0.364	2.600	0.424	3.033	-0.333	-3.370	0.243	1.733	0.091	0.460	-0.105	-0.613	0.263	1.532	0.210	1.226	0.775	9.892	0.927
63	0.189	1.324	0.189	1.324	-0.694	-6.868	0.126	0.883	-0.063	-0.237	0.219	1.249	-0.055	-0.312	0.273	1.561	0.765	9.356	0.832
64	-0.061	-0.303	-0.428	-2.119	-0.565	-3.861	0.244	1.211	0.183	0.642	0.397	1.606	0.079	0.321	-0.291	-1.178	0.532	3.266	0.606
65	0.107	0.502	-0.321	-1.505	-0.536	-3.548	0.107	0.510	-0.071	-0.240	0.371	1.419	0.196	0.710	0.000	0.000	0.476	2.609	0.552
66	0.111	0.510	-0.258	-1.190	-0.498	-3.246	0.111	0.510	-0.074	-0.195	0.351	1.323	0.287	1.082	-0.096	-0.361	0.459	2.443	0.587
67	0.039	0.232	-0.273	-1.624	-0.527	-4.428	0.273	1.624	-0.195	-0.820	0.372	1.804	0.507	2.460	-0.034	-0.164	0.674	5.945	0.789
68	0.035	0.189	-0.314	-1.698	-0.453	-3.469	0.244	1.321	0.035	0.133	0.362	1.601	0.423	1.868	-0.121	-0.534	0.808	4.450	0.693
69	0.095	0.549	-0.350	-2.014	-0.541	-4.402	0.414	2.380	0.255	1.036	0.276	1.295	0.276	1.295	-0.386	-1.813	0.653	5.406	0.732
70	0.057	0.317	-0.456	-2.535	-0.513	-4.034	0.399	2.218	0.371	1.457	0.197	0.896	0.197	0.896	-0.494	-2.241	0.628	4.852	0.771
71	-0.155	-0.871	-0.413	-2.323	-0.554	-4.414	0.361	2.032	0.103	0.411	0.201	0.924	0.469	2.156	-0.380	-1.745	0.637	5.047	0.811
72	-0.058	-0.325	-0.347	-1.949	-0.621	-4.940	0.173	0.975	-0.058	-0.230	0.425	1.953	0.375	1.723	-0.175	-0.804	0.636	5.028	0.875
73	0.064	0.353	-0.321	-1.764	-0.530	-4.115	0.193	1.058	0.000	0.000	0.417	1.871	0.362	1.621	-0.139	-0.624	0.619	4.665	0.819
74	0.222	1.191	-0.222	-1.191	-0.535	-4.071	0.222	1.191	0.000	0.000	0.288	1.263	0.288	1.263	-0.096	-0.421	0.602	4.356	0.720
75	0.116	0.714	-0.116	-0.714	-0.549	-4.796	0.347	2.142	0.376	1.641	0.150	0.757	0.301	1.514	-0.301	-1.514	0.698	6.650	0.880
76	0.181	1.104	-0.397	-2.428	-0.506	-4.371	0.253	1.545	0.000	0.000	0.313	1.561	0.313	1.561	0.000	0.000	0.692	6.469	0.627
77	-0.029	-0.137	-0.321	-1.508	-0.511	-3.393	0.146	0.686	-0.117	-0.388	0.177	0.679	0.430	1.648	-0.291	-0.478	2.632	6.669	0.669
78	-0.065	-0.346	-0.387	-2.077	-0.581	-4.362	0.221	1.107	-0.095	-0.336	0.300	1.230	0.300	1.230	-0.136	-0.559	0.544	3.427	0.883
79	-0.065	-0.346	-0.387	-2.077	-0.581	-4.362	0.221	1.107	-0.095	-0.336	0.300	1.230	0.300	1.230	-0.136	-0.559	0.544	3.427	0.883
80	0.122	0.682	-0.122	-0.682	-0.503	-3.978	0.488	2.727	0.213	0.844	0.185	0.844	0.343	1.567	-0.343	-1.567	0.632	4.940	0.695
81	0.029	0.193	-0.029	-0.193	-0.530	-5.058	0.430	2.900	0.143	0.683	0.124	0.683	0.571	3.144	-0.323	-1.777	0.747	8.501	0.873
82	0.125	0.692	-0.063	-0.346	-0.564	-4.405	0.376	2.077	0.250	0.979	0.108	0.489	0.325	1.468	-0.325	-1.468	0.624	4.762	0.780
83	-0.160	-0.747	0.000	0.000	-0.414	-2.729	0.107	0.498	0.080	0.264	0.069	0.264	0.532	2.025	-0.023	-0.088	0.471	2.558	0.621
84	-0.089	-0.627	0.325	2.300	-0.503	-5.027	0.030	0.209	-0.266	-1.331	0.205	1.183	0.615	3.549	-0.164	-0.805	0.880	6.109	0.580
85	-0.166	-0.996	0.356	2.134	-0.332	-2.817	0.404	2.419	0.360	1.610	0.041	0.201	0.370	1.811	-0.122	-0.687	0.759	9.044	0.770
86	0.117	0.809	0.352	2.428	-0.539	-5.265	0.211	1.457	0.553	2.747	-0.122	-0.687	0.203	1.144	-0.122	-0.687	0.759	9.044	0.770
87	0.076	0.612	0.535	4.287	-0.611	-6.928	0.127	1.021	0.356	2.021	-0.132	-0.866	0.098	0.577	0.132	0.866	0.821	13.196	0.831
88	0.262	2.413	0.501	4.506	-0.644	-8.376	0.119	1.097	0.381	2.482	0.000	0.000	-0.041	-0.310	0.000	0.000	0.864	18.297	0.933
89	0.326	2.441	0.218	1.627	-0.490	-5.177	0.163	1.220	0.136	0.719	0.188	1.151	0.236	1.438	0.047	0.288	0.794	11.097	0.888
90	0.125	0.580	0.062	0.490	-0.296	-3.290	0.125	0.580	-0.249	-1.385	0.404	2.598	0.512	3.290	0.297	1.905	0.814	12.595	0.755

$F > 2.51 = p < .05$; $t > 2.10 = p < .05$; $R^2 > .503 = p < .05$; Reliability $> .554 = p < .05$

APPENDIX I, page 3
Study 3, Part 2 (Pre-Feedback) – Individual level Results

Conjoint Analysis 3: Part 1 of Study 3																			
Person	β Value	t-ratio	β Rarity	t-ratio	β Inability	t-ratio	β Limits	t-ratio	β Relatedness	t-ratio	β Rel' Rarity	t-ratio	β Rel' Value	t-ratio	β Rel' Limits	t-ratio	R ²	F-Statistic	Reliability
91	0.309	1.253	-0.221	-0.895	-0.133	-0.508	-0.229	2.741	-0.265	-0.759	0.230	0.759	0.230	0.759	0.230	0.759	0.299	1.225	0.474
92	0.483	5.786	0.076	0.914	-0.508	-8.614	0.229	2.741	0.229	1.938	0.308	3.015	0.000	0.000	0.132	1.292	0.920	33.016	0.917
93	0.450	4.125	0.200	1.833	-0.525	-8.806	0.200	1.833	0.130	0.972	0.087	0.648	0.130	0.972	0.173	1.296	0.863	18.116	0.825
94	0.397	3.035	0.397	3.035	-0.447	-4.829	0.132	1.012	0.232	1.252	-0.029	-0.179	0.201	1.252	0.086	0.537	0.803	11.708	0.755
95	0.294	2.232	0.294	2.232	-0.491	-5.261	-0.098	-0.744	0.033	0.175	0.227	1.403	0.227	1.403	0.170	1.052	0.800	11.500	0.787
96	0.334	2.315	0.273	1.894	-0.379	-3.720	0.030	0.210	0.303	1.488	0.184	1.041	0.131	0.744	0.079	0.446	0.761	9.165	0.716
97	0.351	2.238	0.405	2.582	-0.486	-4.382	-0.081	-0.516	0.243	1.096	-0.094	-0.487	0.000	0.243	0.327	1.704	0.717	7.291	0.729
98	0.316	2.103	0.252	1.682	-0.631	-5.948	0.000	0.000	0.252	1.190	-0.055	-0.297	0.000	0.000	0.273	1.487	0.741	8.227	0.813
99	0.195	1.319	0.324	2.198	-0.584	-5.596	0.065	0.440	0.227	1.088	0.000	0.000	0.112	0.622	0.225	1.243	0.750	8.613	0.840
100	0.124	0.768	0.311	1.921	-0.482	-4.210	0.186	1.152	0.249	1.086	0.135	0.679	0.188	0.951	0.027	0.136	0.699	6.677	0.753
101	0.227	1.616	0.293	2.019	-0.453	-4.569	0.227	1.616	0.255	1.285	0.147	0.857	0.196	1.142	0.049	0.286	0.774	9.838	0.836
102	0.195	1.297	0.418	2.779	-0.474	-4.454	0.195	1.297	0.251	1.179	0.000	0.000	0.290	1.572	-0.048	-0.262	0.740	8.170	0.866
103	0.599	4.523	0.249	1.885	-0.362	-3.865	0.200	1.508	0.249	1.333	-0.022	-0.133	0.108	0.666	0.065	0.400	0.799	11.402	0.783
104	0.497	2.825	0.603	3.188	0.106	0.796	0.319	1.688	0.390	1.459	-0.369	-1.591	-0.154	-0.663	0.154	0.663	0.589	4.115	0.422
105	0.613	4.564	0.255	1.902	-0.357	-3.765	0.204	1.521	0.230	1.210	0.044	0.269	0.044	0.269	0.088	0.538	0.793	11.003	0.765
106	0.575	4.367	0.275	2.089	-0.375	-4.028	0.225	1.709	0.250	1.343	-0.043	-0.269	0.130	0.806	0.043	0.269	0.801	11.545	0.798
107	0.447	4.303	0.336	3.227	-0.308	-4.184	0.447	4.303	0.224	1.521	0.048	0.390	0.048	0.390	0.145	1.141	0.876	20.252	0.776
108	0.497	2.825	0.603	3.188	0.106	0.796	0.319	1.688	0.390	1.459	-0.369	-1.591	-0.154	-0.663	0.154	0.663	0.589	4.115	0.422
109	0.676	3.774	-0.023	-0.130	-0.303	-2.393	0.257	1.432	0.117	0.460	0.444	2.025	-0.162	-0.736	-0.162	-0.736	0.631	4.912	0.711
110	0.510	3.152	0.188	1.161	-0.363	-3.168	0.081	0.498	-0.269	-1.173	0.023	0.117	0.163	0.821	0.395	1.994	0.699	6.662	0.917
111	0.274	3.327	0.623	7.560	-0.362	-6.201	0.324	3.931	0.424	3.635	-0.108	-1.069	0.022	0.214	0.151	1.497	0.922	33.883	0.886
112	0.269	2.036	0.415	3.146	-0.183	-1.963	0.659	4.997	0.195	1.047	0.148	0.916	-0.106	-0.654	-0.021	-0.131	0.800	11.491	0.635
113	0.031	0.162	0.649	3.411	0.062	0.459	0.216	1.137	0.062	0.230	-0.107	-0.459	0.000	0.000	0.321	1.378	0.584	4.029	0.411
114	-0.057	-0.249	0.511	2.239	0.085	0.528	0.398	1.742	0.227	0.704	-0.344	-1.232	0.541	1.935	-0.443	-1.583	0.400	1.919	0.365
115	-0.024	-0.185	-0.166	-1.295	0.473	5.233	-0.213	1.665	0.544	3.009	-0.287	-1.831	0.123	0.785	0.328	2.093	0.812	12.424	0.765
116	0.438	2.430	0.250	1.389	-0.172	-1.350	0.563	3.124	0.344	1.350	0.081	0.368	-0.027	-0.123	-0.135	-0.614	0.627	4.835	0.478
117	0.472	4.188	0.433	3.839	-0.305	-3.825	0.669	5.932	0.197	1.234	-0.051	-0.370	-0.221	-1.604	0.017	0.123	0.854	16.805	0.868
118	0.297	2.271	0.351	2.684	-0.526	-5.694	0.351	2.684	0.297	1.606	0.023	0.146	-0.023	-0.146	0.117	0.730	0.803	11.745	0.824
119	0.816	4.899	0.084	0.507	0.028	0.239	0.084	0.507	0.253	1.075	0.195	0.958	-0.146	-0.717	0.000	0.000	0.681	6.135	0.612
120	0.378	2.876	0.437	3.318	0.378	4.067	0.553	4.203	0.582	3.128	-0.353	-2.190	0.252	1.564	-0.353	-2.190	0.801	11.561	0.741
121	0.331	1.724	0.248	1.293	-0.145	-1.066	0.165	0.862	0.289	1.066	0.179	0.762	0.250	1.066	-0.250	-1.066	0.577	3.922	0.575
122	0.104	0.606	0.174	1.010	-0.296	-2.429	0.244	1.414	0.244	1.000	0.332	1.571	0.392	1.857	-0.392	-1.857	0.659	5.551	0.530
123	0.078	0.451	0.078	0.451	-0.293	-2.394	0.234	1.354	0.195	0.798	0.372	1.756	0.372	1.756	-0.169	-0.798	0.656	5.476	0.496
124	0.152	0.779	0.152	0.779	-0.190	-1.378	0.303	1.559	0.303	1.102	0.197	0.827	0.329	1.378	-0.197	-0.827	0.564	3.719	0.542
125	0.175	0.844	-0.105	-0.506	-0.210	-1.432	-0.035	-0.169	-0.210	-0.716	0.303	1.193	0.485	1.909	0.182	0.716	0.504	2.925	0.826
126	0.376	2.744	0.125	0.915	-0.063	-0.647	0.209	1.524	0.126	0.216	0.470	2.802	0.181	1.078	0.108	0.647	0.784	10.455	0.802
127	0.168	1.023	0.168	1.023	-0.230	-1.990	0.168	1.023	-0.126	0.445	0.399	1.990	0.399	1.990	0.109	0.543	0.692	6.445	0.584
128	0.119	0.550	-0.040	-0.183	-0.099	-0.649	0.119	0.550	-0.040	-0.130	0.445	1.686	0.377	1.427	-0.034	-0.130	0.466	2.507	0.292
129	0.261	1.258	0.186	0.899	-0.149	-1.017	0.037	0.180	-0.075	-0.254	0.194	0.763	0.388	1.525	0.065	0.254	0.505	2.932	0.431
130	0.133	0.786	0.199	1.179	-0.249	-2.084	0.000	0.000	-0.166	-0.595	0.144	0.695	0.603	2.918	0.201	0.973	0.673	5.909	0.628
131	-0.036	-0.223	0.109	0.668	-0.146	-1.259	-0.182	-1.113	-0.511	-2.204	0.506	2.519	0.632	3.149	0.379	1.889	0.691	6.432	0.804
132	-0.039	-0.275	-0.117	-0.826	-0.146	-1.259	-0.182	-1.113	-0.628	-3.115	0.779	4.477	0.644	3.698	0.237	1.363	0.768	9.511	0.777
133	0.311	2.659	-0.035	-0.295	-0.259	-3.134	0.035	0.295	-0.208	-1.253	0.689	4.805	0.330	2.298	0.090	0.627	0.842	15.362	0.843
134	0.297	1.582	-0.148	-0.791	-0.074	-0.559	0.148	0.791	-0.037	-0.140	0.578	2.517	0.321	1.398	-0.128	-0.559	0.596	4.234	0.584
135	0.514	2.602	-0.198	-1.001	-0.119	-0.849	0.356	1.802	0.277	0.991	0.480	1.982	-0.069	-0.283	-0.208	-0.849	0.551	3.526	0.537

$F > 2.51 = p < .05$; $t > 2.10 = p < .05$; $R^2 > .503 = p > .05$; Reliability $> .554 = p < .05$

Study 3, Part 2 (Pre-Feedback) – Individual level Results

Conjoint Analysis 3 - Part 1 of Study 3																							
Person	β Value	t-ratio	β Rarity	t-ratio	β Limits	t-ratio	β Interability	t-ratio	β Limits	t-ratio	β Relatedness	t-ratio	β Rel/Rarity	t-ratio	β Rel/Value	t-ratio	β Rel/Limits	t-ratio	R ²	F-Statistic	Reliability		
136	0.523	2.934	0.000	0.000	0.000	0.000	0.019	0.148	0.075	0.419	0.336	1.334	0.356	1.630	0.032	1.148	-0.097	-0.445	0.635	5.009	0.649		
137	0.420	3.058	0.000	0.000	-1.297	0.252	1.835	-0.126	-1.297	0.252	1.835	0.336	1.730	0.509	0.327	0.865	-0.291	-1.730	0.783	10.378	0.645		
138	0.480	2.654	0.106	0.612	-1.155	0.248	1.429	-0.142	-1.155	0.248	1.429	0.425	1.732	0.306	1.443	0.061	-0.245	-1.155	0.855	5.448	0.449		
139	0.491	2.952	0.265	1.590	-0.038	0.340	2.044	-0.038	-0.340	2.044	0.454	1.927	0.131	0.642	0.131	0.642	-0.327	-1.606	0.881	6.150	0.702		
140	0.277	1.380	0.040	0.197	-0.059	0.418	0.119	-0.059	-0.418	0.119	0.592	-0.238	0.446	1.843	0.377	1.534	0.034	0.139	0.536	3.325	0.584		
141	0.069	0.339	0.000	0.000	-0.312	-2.155	-0.139	-0.677	-2.155	-0.139	-0.677	-0.520	-1.796	0.360	1.437	0.540	0.360	1.437	0.518	3.090	0.582		
142	-0.221	-1.373	0.147	0.915	-0.608	-5.338	0.000	0.000	-0.608	-5.338	0.000	-0.479	-2.103	0.098	0.485	0.607	0.351	1.779	0.701	6.751	0.793		
143	-0.072	-0.466	0.072	0.466	-0.596	-5.438	0.000	0.000	-0.596	-5.438	0.000	-0.325	-1.483	0.344	1.813	0.407	0.344	1.813	0.723	7.522	0.826		
144	-0.046	-0.223	-0.046	-0.223	-0.502	-3.471	0.046	0.223	-0.502	-3.471	0.046	-0.183	-0.631	0.237	0.947	0.395	0.237	0.947	0.519	3.099	0.823		
145	-0.069	-0.415	0.000	0.000	-0.515	-4.403	0.000	0.000	-0.515	-4.403	0.000	-0.275	-1.174	0.238	1.174	0.536	0.238	1.174	0.685	6.245	0.833		
146	0.032	0.192	-0.095	-0.576	-0.428	-3.667	0.221	1.344	-0.428	-3.667	0.221	-1.358	0.465	2.309	0.519	2.580	0.137	0.679	0.689	6.362	0.834		
147	0.289	1.685	0.173	0.999	-0.318	-2.590	0.347	1.998	-0.318	-2.590	0.347	1.998	-0.471	0.400	1.883	0.250	1.177	-0.100	-0.471	0.854	5.431	0.875	
148	0.271	1.156	0.039	0.165	-0.252	-1.518	0.039	0.165	-0.252	-1.518	0.039	0.584	0.168	0.584	0.034	1.117	0.168	0.584	0.368	1.677	0.638		
149	0.300	1.859	-0.300	-1.859	-0.725	-6.355	0.200	1.240	-0.725	-6.355	0.200	0.100	0.438	0.303	1.534	-0.217	-1.096	0.043	0.219	0.700	6.722	0.725	
150	0.407	2.688	0.000	0.000	-0.465	-4.344	0.291	1.920	-0.465	-4.344	0.291	0.174	0.815	0.302	1.629	-0.050	-0.272	0.151	0.815	0.736	8.035	0.894	
151	0.351	2.188	0.059	0.365	-0.351	-3.094	0.351	2.188	-0.351	-3.094	0.351	0.205	0.902	0.254	1.289	0.152	0.773	0.000	0.000	0.704	6.822	0.856	
152	0.199	1.160	0.000	0.000	-0.315	-2.597	0.398	2.320	-0.315	-2.597	0.398	0.066	0.273	0.316	1.504	0.316	1.504	-0.029	-0.137	0.862	5.624	0.925	
153	0.109	0.618	-0.181	-1.030	-0.399	-3.205	0.327	1.854	-0.399	-3.205	0.327	1.854	-0.440	0.440	2.039	0.440	2.039	0.063	0.291	0.643	5.177	0.820	
154	0.000	0.000	-0.229	-1.354	-0.593	-4.947	0.229	1.354	-0.593	-4.947	0.229	1.354	-0.638	0.431	2.075	0.364	1.756	0.160	0.670	0.583	6.980	0.680	
155	0.265	1.696	-0.113	-0.727	-0.605	-5.481	0.113	0.727	-0.605	-5.481	0.113	0.727	-0.038	-0.171	0.327	1.713	0.128	0.131	0.665	0.720	7.393	0.820	
156	0.136	1.005	-0.391	-2.514	-0.547	-4.977	0.156	1.005	-0.547	-4.977	0.156	1.005	-0.889	0.474	2.488	0.271	1.422	0.203	1.066	0.722	7.472	0.702	
157	0.246	1.502	-0.316	-1.931	-0.369	-3.186	0.246	1.502	-0.369	-3.186	0.246	1.502	-0.607	0.578	2.893	0.274	1.366	0.091	0.455	0.692	6.446	0.787	
158	0.132	0.778	-0.044	-0.259	-0.483	-4.034	0.307	1.915	-0.483	-4.034	0.307	1.915	-0.183	0.304	1.467	0.380	1.834	0.000	0.000	0.671	5.851	0.702	
159	-0.038	-0.240	0.038	0.240	-0.574	-5.100	0.268	1.683	-0.574	-5.100	0.268	1.683	-0.229	0.265	1.360	0.464	2.380	0.132	0.680	0.709	7.007	0.757	
160	0.149	0.919	-0.224	-1.379	-0.579	-5.038	0.149	0.919	-0.579	-5.038	0.149	0.919	-0.261	-1.138	0.614	3.088	0.097	0.488	0.697	6.602	0.748		
161	0.217	1.397	-0.217	-1.397	-0.577	-5.270	0.144	0.932	-0.577	-5.270	0.144	0.932	-0.361	-0.563	2.964	0.250	1.318	0.188	0.988	0.724	7.540	0.791	
162	0.039	0.244	-0.039	-0.244	-0.566	-4.996	0.195	1.218	-0.566	-4.996	0.195	1.218	-0.861	0.101	0.517	0.575	0.292	0.101	0.517	0.705	5.855	0.780	
163	0.557	3.394	0.080	0.483	-0.345	-2.962	0.292	1.772	-0.345	-2.962	0.292	1.772	0.186	0.186	0.184	0.911	-0.046	-0.228	0.689	6.360	0.635		
164	0.646	4.623	0.404	2.889	0.262	2.656	0.161	1.156	0.262	2.656	0.161	1.156	0.525	0.755	0.035	0.204	0.035	0.204	0.776	9.935	0.706		
165	0.557	3.394	0.080	0.483	-0.345	-2.962	0.292	1.772	-0.345	-2.962	0.292	1.772	0.186	0.186	0.184	0.911	-0.046	-0.228	0.689	6.360	0.635		
166	0.557	3.394	0.080	0.483	-0.345	-2.962	0.292	1.772	-0.345	-2.962	0.292	1.772	0.186	0.186	0.184	0.911	-0.046	-0.228	0.689	6.360	0.635		
167	0.523	8.572	0.523	8.572	0.572	7.793	0.475	7.793	0.572	7.793	0.475	7.793	0.309	0.309	0.309	0.309	0.309	0.309	0.309	0.309	0.309	0.309	
168	0.557	3.394	0.080	0.483	-0.345	-2.962	0.292	1.772	-0.345	-2.962	0.292	1.772	0.186	0.186	0.184	0.911	-0.046	-0.228	0.689	6.360	0.635		
169	0.343	1.327	0.086	0.332	-0.064	-0.352	0.257	0.996	-0.064	-0.352	0.257	0.996	0.557	1.525	-0.037	-1.117	-0.631	-1.994	-0.483	-1.525	0.232	0.867	0.702
170	0.646	4.623	0.404	2.889	0.262	2.656	0.161	1.156	0.262	2.656	0.161	1.156	0.525	0.755	0.035	0.204	0.035	0.204	0.776	9.935	0.706		
171	0.305	3.119	0.416	4.254	-0.471	-6.818	0.416	4.254	-0.471	-6.818	0.416	4.254	0.190	1.138	0.123	0.854	0.164	1.138	-0.206	-1.423	0.840	15.094	0.848
172	0.546	4.628	0.309	2.616	-0.237	-2.846	0.498	4.226	-0.237	-2.846	0.498	4.226	0.190	1.138	0.123	0.854	0.164	1.138	-0.206	-1.423	0.840	15.094	0.848
173	0.240	3.405	0.327	4.644	-0.523	-10.507	0.762	10.835	-0.523	-10.507	0.762	10.835	0.414	4.159	-0.075	-0.876	0.038	-0.189	-2.189	0.943	47.629	0.929	
174	0.114	0.791	0.229	1.582	-0.286	-2.797	0.286	1.978	-0.286	-2.797	0.286	1.978	-0.899	0.297	1.678	0.446	2.517	0.149	0.839	0.760	9.085	0.864	
175	0.449	3.485	0.213	1.651	-0.461	-5.059	0.402	3.118	-0.461	-5.059	0.402	3.118	0.237	1.297	0.143	0.908	0.061	-0.389	0.809	12.165	0.805		
176	0.556	5.412	0.404	3.936	0.253	3.479	0.202	1.968	0.253	3.479	0.202	1.968	0.263	2.088	0.175	1.066	0.025	1.392	0.879	20.836	0.957		
177	0.289	2.154	0.289	2.154	-0.217	-2.285	0.289	2.154	-0.217	-2.285	0.289	2.154	0.914	1.715	1.066	0.328	1.980	0.175	1.392	0.879	20.836	0.957	
178	0.585	4.159	0.463	3.435	-0.140	-1.406	0.686	4.892	-0.140	-1.406	0.686	4.892	3.196	-0.242	-1.406	-0.242	-1.406	-0.198	-1.151	0.773	9.775	0.716	
179	0.199	1.082	-0.199	-1.082	-0.060	-0.459	0.438	2.885	-0.060	-0.459	0.438	2.885	-0.153	0.310	1.377	0.241	1.071	0.172	0.765	0.611	4.516	0.716	
180	0.185	1.131	0.000	0.000	-0.231	-1.999	0.308	1.980	-0.231	-1.999	0.308	1.980	-0.153	0.310	1.377	0.241	1.071	0.172	0.765	0.611	4.516	0.716	
																			1.732	0.692	6.465	0.772	

$$F > 2.51 = p < .05; \quad t > 2.10 = p < .05; \quad R^2 > .503 = p_1 > .05; \quad \text{Reliability} > .554 = p < .05$$

APPENDIX I, page 5
Study 3, Part 2 (Pre-Feedback) – Individual level Results

Conjoint Analysis 3 - Part 1 of Study 3																			
Person	β Value	t-ratio	β Rarity	t-ratio	β Immutability	t-ratio	β Limits	t-ratio	β Relatedness	t-ratio	β Rel/Rarity	t-ratio	β Rel/Value	t-ratio	β Rel/Limits	t-ratio	R ²	F-Statistic	Reliability
181	0.183	0.961	0.037	0.192	-0.183	-1.360	0.257	1.346	0.110	0.408	0.000	0.000	0.318	1.360	0.254	1.088	0.581	3.994	0.632
182	0.204	1.272	0.000	0.000	-0.187	-1.649	0.272	1.696	-0.068	-0.300	0.147	0.750	0.383	1.949	0.324	1.649	0.705	6.857	0.772
183	0.225	1.288	0.000	0.000	-0.244	-1.973	0.300	1.717	-0.075	-0.303	0.163	0.759	0.228	1.062	0.358	1.669	0.648	5.295	0.680
184	0.321	1.645	-0.128	-0.658	-0.225	-1.628	0.192	0.987	-0.160	-0.582	0.333	1.396	0.167	0.698	0.333	1.396	0.563	3.700	0.803
185	0.174	0.909	-0.105	-0.546	-0.157	-1.157	0.383	2.000	-0.139	-0.514	0.332	1.414	0.332	1.414	0.151	0.643	0.578	3.935	0.812
186	0.069	0.330	-0.069	-0.330	-0.103	-0.700	0.412	1.979	-0.137	-0.466	0.298	1.166	0.417	1.632	0.060	0.233	0.501	2.882	0.836
187	-0.066	-0.387	-0.066	-0.387	-0.164	-1.369	0.591	3.484	-0.066	-0.274	0.228	1.095	0.569	2.737	-0.057	-0.274	0.669	5.806	0.891
188	0.159	1.030	-0.159	-1.030	-0.223	-2.039	0.159	1.030	-0.191	-0.874	0.386	2.039	0.331	1.748	0.441	2.331	0.726	7.607	0.889
189	0.106	0.606	-0.106	-0.606	-0.195	-1.571	0.177	1.010	-0.213	-0.857	0.399	1.857	0.399	1.857	0.338	1.571	0.646	5.245	0.824
190	0.244	1.367	-0.175	-0.976	-0.052	-0.414	0.244	1.367	-0.175	-0.690	0.454	2.071	0.151	0.690	0.393	1.795	0.632	4.935	0.817
191	0.378	2.038	0.103	0.556	-0.172	-1.310	0.378	2.038	0.206	0.786	0.059	0.262	0.178	0.786	0.059	0.262	0.605	4.403	0.658
192	0.347	2.112	0.069	0.422	-0.226	-1.942	0.347	2.112	0.035	0.149	0.150	0.747	0.150	0.747	0.271	1.344	0.689	6.380	0.820
193	0.256	1.487	0.000	0.000	-0.160	-1.314	0.320	1.858	-0.160	-0.657	0.222	1.051	0.388	1.840	0.222	1.051	0.659	5.551	0.824
194	0.197	1.152	-0.066	-0.384	-0.115	-0.951	0.461	2.689	-0.033	-0.136	0.256	1.222	0.370	1.766	0.085	0.407	0.663	5.644	0.821
195	0.165	0.970	-0.099	-0.582	-0.148	-1.234	0.362	2.133	0.033	0.137	0.257	1.234	0.371	1.783	0.143	0.686	0.668	5.792	0.813
196	0.064	0.360	-0.064	-0.360	-0.270	-2.161	0.191	1.079	-0.222	-0.890	0.247	1.144	0.467	2.161	0.357	1.653	0.641	5.140	0.805
197	0.133	0.756	0.133	0.756	-0.316	-2.540	0.133	0.756	-0.100	-0.401	0.029	0.134	0.432	2.005	0.374	1.738	0.645	5.218	0.872
198	0.299	1.637	0.000	0.000	-0.149	-1.158	0.179	0.982	-0.030	-0.116	0.207	0.926	0.155	0.695	0.414	1.852	0.617	4.631	0.889
199	0.331	2.172	0.331	2.172	-0.248	-2.304	0.132	0.869	-0.099	-0.461	0.372	1.997	-0.201	-1.075	0.430	2.304	0.733	7.903	0.887
200	0.274	1.689	0.479	2.956	-0.205	-1.791	0.205	1.267	-0.171	-0.746	0.296	1.493	-0.059	-0.299	0.237	1.194	0.698	6.653	0.786
201	0.202	1.122	0.472	2.617	-0.169	-1.322	0.270	1.496	-0.034	-0.132	0.117	0.529	0.000	0.000	0.292	1.322	0.626	4.815	0.891
202	0.283	1.602	0.472	2.670	-0.220	-1.762	0.220	1.246	0.063	0.252	0.055	0.252	-0.164	-0.755	0.382	1.762	0.640	5.108	0.921
203	0.306	2.006	0.613	4.012	-0.199	-1.844	0.245	1.605	0.092	0.426	-0.027	-0.142	-0.133	-0.709	0.345	1.844	0.732	7.848	0.937
204	0.247	1.706	0.617	4.264	-0.216	-2.111	0.247	1.706	0.031	0.151	0.053	0.302	-0.107	-0.603	0.320	1.809	0.760	9.080	0.884
205	0.233	1.409	0.566	3.421	-0.266	-2.277	0.166	1.006	0.000	0.000	0.058	0.285	-0.058	-0.285	0.346	1.707	0.685	6.266	0.872
206	0.366	2.046	0.579	3.070	-0.217	-1.628	0.386	2.046	0.386	1.447	-0.042	-0.181	-0.292	-1.266	-0.042	-0.181	0.591	4.155	0.773
207	0.314	1.793	0.314	1.793	-0.366	-2.958	0.174	0.996	-0.070	-0.282	0.272	1.268	-0.151	-0.704	0.332	1.550	0.647	5.279	0.837
208	0.136	0.781	0.408	2.342	-0.204	-1.656	0.204	1.171	-0.102	-0.414	0.118	0.552	0.000	0.000	0.472	2.208	0.650	5.341	0.869
209	0.283	1.696	0.424	2.543	-0.212	-1.798	0.212	1.272	-0.141	-0.599	0.245	1.199	-0.122	-0.599	0.367	1.798	0.680	6.109	0.879
210	0.172	0.909	0.378	2.000	-0.206	-1.543	0.103	0.545	-0.309	-1.157	0.297	1.285	0.000	0.000	0.416	1.800	0.590	4.131	0.812
211	0.234	1.411	0.702	4.233	-0.167	-1.425	0.234	1.411	0.134	0.570	-0.116	-0.570	-0.116	-0.570	0.289	1.425	0.684	6.227	0.904
212	0.257	1.636	0.515	3.272	-0.225	-2.024	0.257	1.636	0.129	0.578	0.056	0.289	-0.111	-0.578	0.334	1.735	0.716	7.235	0.859
213	0.246	1.573	0.526	3.371	-0.263	-2.383	0.105	0.674	0.035	0.159	0.030	0.159	-0.152	-0.794	0.517	2.701	0.719	7.372	0.910
214	0.129	0.727	0.451	2.546	-0.242	-1.929	0.129	0.727	-0.161	-0.643	0.084	0.386	-0.028	-1.129	0.531	2.443	0.638	5.076	0.927
215	0.324	1.597	0.454	2.236	-0.162	-1.129	0.195	0.958	0.195	0.677	0.000	0.000	-0.281	-1.129	0.337	1.355	0.526	3.187	0.864
216	0.269	1.593	0.604	3.584	-0.201	-1.690	0.201	1.195	0.235	0.986	-0.116	-0.563	-0.116	-0.563	0.349	1.690	0.673	5.919	0.965
217	0.230	1.451	0.558	3.523	-0.312	-2.784	0.098	0.622	0.131	0.586	-0.028	-0.147	0.028	0.147	0.369	1.905	0.712	7.108	0.889
Mean	0.228		0.131		-0.320		0.216		0.062		0.159		0.172		0.105		0.664	8.898	0.727

$F > 2.51 = p < .05$; $t > 2.10 = p < .05$; $R^2 > .503 = p > .05$; Reliability $> .554 = p < .05$

APPENDIX I, page 6
Study 3, Part 2 (Post-Feedback) – Individual level Results

Conjoint Analysis 4 - Part 2 of Study 3															Reliability				
Person	β Value	t-ratio	β Ratio	t-ratio	β Intability	t-ratio	β Limits	t-ratio	β Relatedness	t-ratio	β Rel'Value	t-ratio	β Rel'Limits	t-ratio	R ²	F-Statistic	Reliability		
1	0.405	2.833	0.308	2.153	-0.138	-1.362	-0.211	-1.473	0.227	1.122	-0.098	-0.561	0.267	1.522	0.379	2.163	0.765	9.340	0.750
2	0.428	6.694	0.371	5.801	-0.614	-13.568	0.371	5.801	0.428	4.733	-0.025	-0.316	-0.025	-0.316	-0.025	-0.316	0.953	58.147	0.978
3	0.477	7.278	0.477	7.278	-0.466	-10.047	0.477	7.278	0.727	7.842	-0.098	-1.225	-0.177	-2.205	-0.138	-1.715	0.951	53.308	0.945
4	0.405	2.833	0.308	2.153	-0.138	-1.362	-0.211	-1.473	0.227	1.122	-0.098	-0.561	0.267	1.522	0.379	2.163	0.765	9.340	0.750
5	0.145	0.931	0.203	1.303	-0.304	-2.765	0.261	1.676	-0.174	-0.790	0.176	0.922	0.426	2.238	0.276	1.448	0.722	7.453	0.822
6	0.024	0.240	0.448	4.567	-0.684	-9.859	0.212	2.164	0.071	0.510	0.041	0.340	0.286	2.380	0.041	0.340	0.889	23.116	0.902
7	0.569	4.389	0.272	2.099	-0.111	-1.215	0.322	2.481	0.148	0.810	0.107	0.675	0.150	0.945	0.064	0.405	0.807	12.001	0.745
8	0.106	0.772	0.528	3.859	-0.123	-1.273	0.106	0.772	0.352	1.819	0.092	0.546	0.153	0.910	0.153	0.910	0.784	10.458	0.895
9	0.216	1.206	0.031	0.172	-0.015	-0.122	0.711	3.961	-0.166	-0.731	-0.027	-0.122	0.348	1.583	-0.134	-0.609	0.629	4.879	0.411
10	0.485	6.116	0.383	4.828	-0.383	-6.828	0.485	6.116	0.434	3.869	-0.088	-0.910	0.088	0.910	-0.044	-0.455	0.928	36.883	0.908
11	0.566	5.826	0.340	3.496	-0.396	-5.768	0.385	3.962	0.589	4.284	-0.333	-2.801	0.059	0.494	-0.021	-0.165	0.892	23.625	0.838
12	0.716	10.746	0.025	0.371	-0.037	-0.786	0.222	3.335	0.247	2.620	0.235	2.882	0.150	1.834	-0.021	-0.262	0.949	53.484	0.948
13	0.242	2.897	0.296	3.541	-0.242	-4.087	0.350	4.184	0.188	1.593	0.093	0.910	0.373	3.642	0.140	1.366	0.920	32.946	0.918
14	0.353	1.783	0.353	1.783	-0.176	-1.261	0.417	2.107	0.385	1.375	-0.139	-0.573	0.083	0.344	-0.028	-0.115	0.550	3.507	0.617
15	0.639	8.298	0.213	2.766	-0.438	-8.041	0.307	3.995	0.662	6.085	-0.143	-1.521	-0.020	-0.217	-0.102	-1.087	0.932	39.341	0.951
16	0.339	3.240	0.113	1.080	-0.212	-2.864	0.339	3.240	-0.056	-0.382	0.318	2.482	0.416	3.246	0.073	0.573	0.874	19.975	0.850
17	0.381	5.519	0.163	2.365	-0.163	-3.345	0.163	2.365	0.082	0.836	0.330	3.903	0.283	3.345	0.236	2.788	0.945	49.613	0.949
18	0.485	2.101	0.233	1.050	-0.029	-0.186	0.233	1.050	0.291	0.928	0.151	0.557	-0.101	-0.371	0.000	0.000	0.436	2.224	0.204
19	0.414	4.568	0.249	2.741	-0.055	-0.861	0.304	3.350	0.166	1.292	0.144	1.292	0.335	3.015	0.096	0.861	0.905	27.521	0.929
20	0.356	3.119	0.192	1.680	-0.096	-1.188	0.247	2.159	0.027	0.170	0.261	1.866	0.309	2.206	0.214	1.527	0.850	16.264	0.912
21	0.340	3.025	0.227	2.017	-0.198	-2.495	0.170	1.512	-0.028	-0.178	0.147	1.069	0.344	2.495	0.344	2.495	0.855	16.885	0.892
22	0.365	2.704	0.309	2.288	-0.155	-1.618	0.253	1.872	0.281	1.471	0.024	0.147	0.219	1.324	0.170	1.030	0.790	10.818	0.826
23	0.429	5.481	0.268	3.426	-0.054	-0.969	0.268	3.426	0.134	1.211	0.166	1.938	0.232	2.422	0.232	2.422	0.930	37.932	0.945
24	0.470	4.752	0.313	3.168	-0.235	-3.360	0.261	2.640	0.183	1.307	0.000	0.000	0.316	2.613	0.090	0.747	0.888	22.704	0.925
25	0.468	4.431	0.208	1.969	-0.143	-1.915	0.260	2.462	0.026	0.174	0.158	1.219	0.293	2.263	0.203	1.567	0.872	19.515	0.884
26	0.415	3.834	0.194	1.789	-0.166	-2.169	0.249	2.301	0.083	0.542	0.144	1.084	0.287	2.169	0.239	1.807	0.865	18.491	0.893
27	0.467	4.102	0.292	2.563	-0.029	-0.363	0.233	2.051	0.117	0.725	0.101	0.725	0.253	1.813	0.202	1.450	0.851	16.429	0.873
28	0.483	4.711	0.312	3.048	-0.327	-4.507	0.199	1.940	0.057	0.392	0.025	0.196	0.221	1.764	0.271	2.155	0.879	20.927	0.920
29	0.294	2.409	0.241	1.971	-0.147	-1.704	0.241	1.971	-0.107	-0.519	0.162	1.084	0.440	2.942	0.255	1.704	0.829	13.910	0.877
30	0.441	4.557	0.275	2.848	-0.096	-1.410	0.165	1.709	0.110	0.806	0.215	1.813	0.167	1.410	0.310	2.618	0.892	23.852	0.934
31	0.431	4.657	0.162	1.746	-0.067	-1.029	0.216	2.328	0.108	0.823	0.257	2.264	0.303	2.676	0.163	1.441	0.901	26.304	0.953
32	0.476	4.796	0.284	2.664	-0.106	-1.507	0.159	1.599	0.132	0.942	0.183	1.507	0.183	1.507	0.275	2.261	0.887	22.521	0.923
33	0.448	4.315	0.090	0.863	-0.149	-2.034	0.209	2.013	0.000	0.000	0.259	2.034	0.362	2.847	0.155	1.220	0.876	20.290	0.925
34	0.209	1.455	0.052	0.364	-0.117	-1.157	0.209	1.455	-0.052	-0.257	0.339	1.929	0.429	2.443	0.203	1.157	0.763	9.260	0.781
35	0.377	3.742	0.270	2.673	-0.135	-1.890	0.162	1.604	0.027	0.189	0.233	1.890	0.280	2.268	0.280	2.268	0.883	21.696	0.931
36	0.242	2.897	0.296	3.541	-0.242	-4.097	0.350	4.184	0.188	1.593	0.093	0.910	0.373	3.642	0.140	1.366	0.920	32.946	0.918
37	0.353	1.783	0.353	1.783	-0.176	-1.261	0.417	2.107	0.385	1.375	-0.139	-0.573	0.083	0.344	-0.028	-0.115	0.550	3.507	0.617
38	0.639	8.298	0.213	2.766	-0.438	-8.041	0.307	3.995	0.662	6.085	-0.143	-1.521	-0.020	-0.217	-0.102	-1.087	0.932	39.341	0.951
39	0.170	1.079	0.113	0.719	-0.410	-3.687	0.226	1.438	0.170	0.763	0.122	0.636	0.192	1.366	0.239	1.653	0.716	7.241	0.945
40	0.166	1.062	0.221	1.682	-0.553	-5.948	0.221	1.682	0.166	0.892	0.048	0.297	0.122	0.936	0.190	1.487	0.801	11.588	0.879
41	0.152	1.082	0.091	0.649	-0.534	-5.354	0.274	1.947	0.000	0.000	0.185	1.071	0.238	1.377	0.238	1.377	0.772	9.710	0.859
42	0.129	0.786	0.064	0.393	-0.466	-4.030	0.386	2.358	0.064	0.278	0.195	0.973	0.195	0.973	0.139	0.695	0.692	6.469	0.877
43	0.119	0.654	0.059	0.327	-0.416	-3.238	0.416	2.290	0.148	0.578	0.257	1.156	0.103	0.463	0.051	0.231	0.621	4.714	0.846
44	0.151	0.948	0.151	0.948	-0.423	-3.753	0.453	2.844	0.121	0.536	0.262	1.340	0.105	0.536	0.052	0.268	0.708	6.963	0.886
45	0.031	0.176	0.275	1.587	-0.412	-3.367	0.275	1.587	0.061	0.249	0.079	0.374	0.238	1.122	0.238	1.122	0.656	5.474	0.743

$F > 2.51 = p < .05$; $t > 2.10 = p < .05$; $R^2 > .503 = p > .05$; Reliability $> .554 = p < .05$

Study 3, Part 2 (Post-Feedback) – Individual level Results

Conjoint Analysis 4 - Part 2 of Study 3																	
Person	β Value	t-ratio	β Rarity	t-ratio	β Inimitability	t-ratio	β Limits	t-ratio	β Relatedness	t-ratio	β Rel/Rarity	t-ratio	β Rel/Value	t-ratio	R ²	F-Statistic	Reliability
46	0.000	0.000	0.228	1.481	-0.499	-4.560	0.171	1.110	0.000	0.000	0.074	0.393	0.321	1.701	0.727	7.638	0.878
47	0.116	0.851	0.174	1.277	-0.522	-5.417	0.348	2.553	0.087	0.451	0.050	0.301	0.201	1.204	0.251	1.505	0.787
48	0.253	2.068	0.141	1.149	-0.576	-6.863	0.309	2.528	0.197	1.138	0.073	0.488	0.073	0.488	0.219	1.463	0.828
49	0.295	1.964	0.118	0.786	-0.472	-4.445	0.354	2.357	0.147	0.695	0.204	1.111	0.153	0.833	0.051	0.278	0.741
50	0.363	2.341	0.654	4.214	-0.048	-0.441	0.412	2.654	0.388	1.766	-0.252	-1.324	0.168	0.883	-0.041	0.723	8.498
51	0.250	2.128	0.292	2.482	-0.573	-6.896	0.417	3.546	0.438	2.633	-0.126	-0.878	0.271	1.881	-0.199	-1.379	0.841
52	0.603	5.000	0.452	3.750	-0.377	-4.419	0.000	0.000	0.025	0.147	0.087	0.589	0.000	0.000	0.218	1.473	0.833
53	0.370	2.827	0.476	3.650	-0.264	-2.856	0.592	4.443	0.185	1.000	-0.046	-0.286	0.183	1.142	-0.137	-0.857	0.803
54	0.038	0.252	0.462	3.021	0.077	0.712	0.192	1.259	1.019	4.717	-0.533	-2.848	0.133	0.712	-0.067	-0.356	0.731
55	0.653	7.588	-0.146	-1.751	0.073	1.238	0.293	3.502	0.293	2.477	-0.211	-2.064	0.127	1.238	0.211	2.064	0.920
56	0.635	3.633	0.415	2.725	-0.357	-3.319	0.138	0.908	0.069	0.321	-0.060	-0.321	0.100	0.535	0.140	0.749	0.734
57	0.248	1.712	0.138	0.951	-0.235	-2.287	0.414	2.854	0.138	0.673	0.215	1.211	0.359	2.018	-0.024	-0.135	0.758
58	0.426	2.195	0.183	0.941	-0.107	-0.776	0.304	1.568	0.091	0.333	-0.079	-0.333	0.290	1.220	0.026	0.111	0.567
59	0.571	4.866	0.381	3.244	-0.369	-4.444	0.286	2.433	0.143	0.860	0.186	1.290	-0.062	-0.430	0.062	0.430	0.841
60	0.231	2.361	0.405	4.132	-0.405	-5.844	0.173	1.771	0.231	1.670	-0.050	-0.417	0.250	2.087	0.301	2.505	0.890
61	0.387	1.499	-0.043	-0.165	0.086	0.468	-0.129	-0.496	-0.129	-0.351	-0.075	-0.234	0.000	0.000	0.373	1.170	0.222
62	0.149	1.488	0.209	2.085	-0.299	-4.239	0.448	4.496	0.000	0.000	0.104	0.848	0.466	3.815	0.155	1.272	0.886
63	0.577	3.976	0.128	0.883	-0.497	-4.841	0.128	0.883	-0.032	-0.156	0.083	0.469	0.028	0.156	0.250	1.406	0.758
64	0.534	2.630	0.320	1.578	0.027	0.186	0.320	1.578	0.454	1.561	-0.139	-0.558	0.000	0.000	-0.092	-0.372	0.526
65	0.434	3.861	0.281	2.498	-0.077	-0.963	0.179	1.590	0.153	0.963	0.133	0.593	0.310	2.248	0.133	0.963	0.854
66	0.412	4.680	0.267	3.028	-0.061	-0.973	0.218	2.478	0.145	1.168	0.147	1.363	0.315	2.920	0.189	1.752	0.911
67	0.465	4.010	0.103	0.891	-0.168	-2.048	0.259	2.228	0.155	0.945	0.246	1.733	0.202	1.418	0.157	1.103	0.845
68	0.520	4.522	0.082	0.714	-0.246	-3.029	0.137	1.190	-0.082	-0.505	0.379	2.693	0.190	1.346	0.237	1.693	0.848
69	0.444	3.461	0.207	1.615	-0.237	-2.611	0.089	0.692	-0.118	-0.653	0.307	1.958	0.256	1.632	0.256	1.632	0.811
70	0.454	3.619	0.187	1.490	-0.254	-2.860	0.027	0.213	-0.027	-0.151	0.116	0.753	0.300	1.957	0.347	2.258	0.819
71	0.497	3.367	0.249	1.684	-0.037	-0.357	0.149	1.010	0.099	0.476	0.065	0.357	0.151	0.833	0.323	1.786	0.749
72	0.490	3.851	0.232	1.824	-0.052	-0.573	0.335	2.635	0.026	0.143	0.223	1.433	0.223	1.433	0.089	0.573	0.614
73	0.496	6.670	0.220	2.964	-0.096	-1.834	0.220	2.964	-0.055	-0.524	0.215	2.398	0.262	2.882	0.310	3.406	0.936
74	0.380	5.061	0.217	2.892	-0.163	-3.067	0.271	3.615	0.054	0.511	0.141	1.534	0.329	3.579	0.282	3.067	0.935
75	0.460	4.808	0.135	1.414	-0.095	-1.400	0.243	2.546	-0.054	-0.400	0.117	1.000	0.351	3.000	0.304	2.600	0.895
76	0.530	5.230	0.139	1.376	-0.209	-2.920	0.195	1.927	0.084	0.584	0.169	1.363	0.286	2.141	0.169	1.363	0.882
77	0.373	2.783	0.267	1.988	-0.240	-2.530	0.267	1.988	0.053	0.281	0.185	1.125	0.231	1.406	0.185	1.125	0.793
78	0.416	3.244	0.416	3.244	-0.061	-0.675	0.269	2.099	0.073	0.405	0.021	0.135	0.148	0.945	0.318	2.024	0.811
79	0.389	4.102	0.233	2.461	-0.142	-1.212	0.130	1.367	-0.078	-0.580	0.292	2.514	0.292	2.514	0.337	2.901	0.897
80	0.473	3.755	0.193	1.546	-0.125	-1.406	0.250	1.988	-0.139	-0.781	0.265	1.718	0.265	1.718	0.217	1.406	0.817
81	0.542	5.648	0.129	1.345	-0.181	-2.662	0.284	2.958	-0.026	-0.190	0.313	2.662	0.223	1.902	0.134	1.141	0.894
82	0.546	5.312	0.130	1.285	-0.195	-2.683	0.286	2.782	0.078	0.537	0.293	2.325	0.203	1.610	0.088	0.537	0.879
83	0.150	1.000	0.349	2.333	-0.100	-0.943	0.100	0.667	0.075	0.354	0.173	0.943	0.346	1.886	0.269	1.414	0.742
84	0.499	4.502	0.382	3.443	-0.470	-5.992	0.382	3.442	0.411	2.621	0.051	0.374	0.000	0.000	-0.153	-0.123	0.858
85	0.509	4.888	0.463	4.443	-0.347	-4.713	0.463	4.443	0.764	5.184	-0.200	-1.571	-0.080	-0.628	-0.160	-1.257	0.875
86	0.369	2.272	0.628	3.863	-0.092	-0.803	0.037	0.227	0.554	2.410	-0.448	-2.249	0.224	1.125	0.084	0.321	0.696
87	0.050	0.318	0.448	2.862	-0.274	-2.473	0.498	3.160	0.448	2.023	-0.172	-0.899	0.560	2.923	-0.517	-2.698	0.718
88	0.241	1.802	0.531	3.955	-0.434	-4.588	0.289	2.163	0.410	1.649	-0.084	-0.510	0.292	1.784	-0.292	-1.784	0.794
89	0.373	2.664	0.316	2.265	-0.244	-2.464	0.373	2.664	0.287	1.417	0.174	1.015	0.124	0.725	-0.025	-0.145	0.774

$F > 2.51 = p < .05$; $t > 2.10 = p < .05$; $R^2 > .503 = p > .05$; Reliability $> .554 = p < .05$

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Study 3, Part 2 (Post-Feedback) – Individual level Results

Conjoint Analysis 4 - Part 2 of Study 3																			
Person	β	Value	t -ratio	β	Value	t -ratio	β	Value	t -ratio	β	Value	t -ratio	β	Value	t -ratio	β	Value	t -ratio	Reliability
90	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.872
91	0.127	0.632	-0.064	-0.316	0.000	0.000	0.635	3.162	0.445	1.565	-0.224	0.385	1.565	-0.224	0.385	1.565	-0.224	0.385	0.526
92	0.396	3.077	0.347	2.692	-0.322	-3.535	0.446	3.461	0.644	3.535	-0.043	-0.272	0.129	0.882	-0.128	-0.882	0.839	15.013	0.834
93	0.492	4.159	0.393	3.327	-0.393	-4.705	0.442	3.743	0.516	3.088	-0.255	-1.764	0.128	0.882	-0.128	-0.882	0.839	15.013	0.834
94	0.400	2.196	0.339	1.858	-0.216	-1.672	0.523	2.872	0.400	1.553	0.107	0.478	-0.107	-0.478	-0.107	-0.478	0.618	4.651	0.645
95	0.277	1.879	0.277	1.879	-0.262	-2.510	0.565	3.967	0.492	2.362	0.346	1.919	-0.027	-0.148	-0.453	-2.510	0.750	8.633	0.725
96	0.279	2.044	0.217	1.590	-0.279	-2.890	0.589	4.315	0.279	1.445	0.376	2.248	0.161	0.963	-0.376	-2.248	0.785	10.520	0.849
97	0.248	1.800	0.193	1.244	-0.220	-2.011	0.468	3.022	0.220	1.005	0.382	2.011	0.286	1.508	-0.382	-2.011	0.724	7.543	0.713
98	0.176	0.949	0.353	1.898	-0.367	-2.796	0.353	1.898	0.353	1.342	-0.025	-0.112	0.025	0.112	0.076	-0.336	0.603	4.365	0.508
99	0.274	1.865	0.456	3.109	-0.258	-2.491	0.395	2.694	0.517	2.491	0.026	0.147	0.079	0.440	-0.132	-0.733	0.752	8.740	0.770
100	0.374	2.405	0.317	2.035	-0.288	-2.616	0.489	3.145	0.403	1.831	0.100	0.523	-0.050	-0.262	-0.050	-0.262	0.722	7.453	0.801
101	0.466	3.510	0.411	3.097	-0.260	-2.774	0.575	4.336	0.411	2.190	0.024	0.146	0.024	0.146	-0.214	-1.314	0.797	11.319	0.895
102	0.409	3.341	0.300	2.450	-0.286	-3.308	0.518	4.232	0.436	2.520	0.259	1.733	0.071	0.473	-0.354	-2.363	0.828	13.845	0.871
103	0.315	2.598	0.090	0.771	-0.551	-6.676	0.090	0.771	0.719	4.360	-0.097	-0.681	-0.058	-0.409	0.058	0.409	0.844	15.500	0.861
104	0.301	2.181	0.261	1.891	-0.573	-5.862	0.422	3.054	0.583	2.982	-0.017	-0.103	0.052	0.309	-0.296	-1.748	0.781	10.226	0.830
105	0.292	2.453	0.112	0.943	-0.561	-6.671	0.112	0.943	0.718	4.270	-0.117	-0.801	-0.039	-0.267	-0.039	-0.267	0.837	14.784	0.838
106	0.309	2.657	0.088	0.762	-0.552	-6.734	0.088	0.762	0.729	4.444	-0.115	-0.808	-0.038	-0.269	0.038	0.269	0.845	15.699	0.867
107	0.093	0.573	0.466	2.866	-0.373	-3.243	0.280	1.720	0.187	0.811	-0.081	-0.405	0.162	0.811	-0.242	-1.216	0.696	6.571	0.723
108	0.301	2.181	0.261	1.891	-0.573	-5.862	0.422	3.054	0.583	2.982	-0.017	-0.103	0.052	0.309	-0.296	-1.748	0.781	10.226	0.830
109	0.349	1.941	-0.044	-0.243	-0.316	-2.487	0.218	1.213	0.327	1.285	-0.019	-0.086	0.283	1.285	-0.057	-0.257	0.628	4.854	0.437
110	0.704	5.229	0.302	2.241	-0.440	-4.622	0.252	1.867	0.201	1.056	-0.153	-0.924	-0.065	-0.396	0.065	0.396	0.791	10.898	0.881
111	0.287	3.250	0.496	5.613	-0.431	-6.894	0.549	6.204	0.653	5.223	-0.068	-0.627	-0.068	-0.627	-0.158	-1.462	0.910	29.110	0.878
112	0.427	2.796	0.370	2.423	-0.427	-3.954	0.484	3.169	0.114	0.527	0.148	0.791	-0.049	-0.264	-0.148	-0.791	0.731	7.826	0.612
113	0.488	2.723	0.231	1.290	0.000	0.000	0.642	3.583	0.334	1.317	0.133	0.608	-0.133	-0.608	-0.178	-0.811	0.631	4.908	0.461
114	0.000	0.000	0.266	1.136	-0.133	-0.803	-0.355	-1.514	-0.222	-0.669	-0.384	-1.338	0.538	1.874	0.077	0.268	0.368	1.675	0.098
115	0.211	1.255	-0.332	-1.972	0.558	4.691	0.211	1.255	0.664	2.789	-0.053	-0.269	0.213	1.074	-0.131	-0.634	0.674	5.947	0.617
116	0.277	1.709	0.400	2.468	-0.154	-1.343	0.523	3.228	-0.031	-0.134	-0.063	-0.269	0.213	1.074	0.107	0.537	0.698	6.633	0.719
117	0.415	3.013	0.200	1.450	-0.054	-0.552	0.692	5.021	-0.123	-0.631	-0.146	-0.868	-0.067	-0.394	0.120	0.710	0.782	10.296	0.781
118	0.159	1.412	0.212	1.882	-0.596	-7.486	0.318	2.823	0.424	2.662	0.023	0.166	0.023	0.166	0.115	0.832	0.854	18.856	0.891
119	0.614	5.033	0.159	1.305	-0.250	-2.900	0.341	2.796	0.137	0.791	0.118	0.791	0.158	1.054	0.000	0.000	0.829	13.906	0.776
120	0.363	3.092	0.208	1.757	0.584	7.028	0.571	4.859	0.052	0.312	-0.112	-0.781	0.157	1.093	-0.112	-0.781	0.841	15.220	0.847
121	0.159	0.896	0.159	0.896	-0.493	-3.930	-0.286	-1.614	-0.159	-0.634	-0.138	-0.634	0.358	1.648	0.579	2.662	0.638	5.063	0.846
122	0.197	0.998	0.028	0.143	-0.408	-2.924	-0.197	-0.998	-0.197	-0.706	-0.024	-0.101	0.317	1.311	0.560	2.319	0.552	3.547	0.759
123	0.204	1.018	0.136	0.678	-0.390	-2.758	-0.136	-0.678	-0.136	-0.480	-0.088	-0.360	0.323	1.319	0.500	2.039	0.539	3.366	0.770
124	0.111	0.571	0.184	0.951	-0.535	-3.901	-0.111	-0.571	0.111	0.404	0.032	0.135	0.223	0.942	0.223	0.942	0.568	3.782	0.712
125	0.264	1.385	0.188	0.989	-0.509	-3.778	-0.188	-0.989	0.113	0.420	-0.032	-0.140	0.163	0.700	0.294	1.259	0.563	4.013	0.821
126	0.325	2.164	0.036	0.240	-0.541	-5.100	-0.253	-1.683	0.072	0.340	0.188	1.020	0.062	0.340	0.438	2.380	0.741	8.220	0.807
127	0.208	1.225	0.069	0.408	-0.555	-4.619	0.000	0.000	0.277	1.155	0.180	0.866	-0.120	-0.577	0.300	1.443	0.668	5.792	0.796
128	0.034	0.199	0.170	0.993	-0.629	-5.194	0.034	0.199	0.340	1.404	-0.029	-0.140	0.086	0.421	0.147	0.702	0.662	5.637	0.815
129	0.119	0.599	0.277	1.771	-0.614	-5.544	-0.040	-0.263	0.119	0.537	-0.103	-0.537	0.309	1.610	0.240	1.252	0.718	7.325	0.892
130	0.123	0.694	0.041	0.231	-0.449	-3.598	-0.123	-0.694	0.041	0.164	0.142	0.654	0.354	1.635	0.283	1.308	0.641	5.135	0.722
131	0.274	1.507	0.117	0.646	-0.313	-2.436	-0.166	-1.077	0.352	1.370	-0.068	-0.305	0.136	0.609	0.339	1.523	0.620	4.683	0.660
132	0.479	2.705	0.160	0.902	-0.431	-3.442	-0.224	-1.262	0.192	0.765	-0.028	-0.127	-0.028	-0.127	0.415	1.912	0.639	5.088	0.671
133	0.250	1.451	0.250	1.451	-0.483	-3.957	-0.179	-1.036	0.143	0.586	0.093	0.440	0.031	0.147	0.403	1.905	0.657	5.519	0.710
134	0.101	0.622	0.236	1.451	-0.523	-4.543	0.169	1.036	0.135	0.586	0.088	0.440	0.205	1.026	0.205	1.026	0.695	6.550	0.735
135	0.127	0.649	0.127	0.649	-0.350	-2.524	0.064	0.324	0.095	0.344	-0.220	-0.918	0.276	1.147	0.441	1.835	0.558	3.625	0.802

$F > 2.51 = p < .05$; $t > 2.10 = p < .05$; $R^2 > .503 = p < .05$; Reliability $> .554 = p < .05$

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Study 3, Part 2 (Post-Feedback) – Individual level Results

Person	β Value	t -ratio	β Rarity	t -ratio	β Limits	t -ratio	β Relatedness	t -ratio	β Rel'arity	t -ratio	β Rel'Value	t -ratio	β Rel'Limits	t -ratio	R^2	F-Statistic	Reliability
136	0.192	1.044	0.192	1.044	-0.336	-2.584	0.000	0.000	-0.139	-0.615	0.250	1.107	0.527	2.338	0.611	4.512	0.826
137	0.313	1.639	0.063	0.328	-0.313	-2.318	-0.556	0.000	-0.108	-0.464	0.217	0.927	0.541	2.318	0.582	4.004	0.674
138	0.199	1.064	0.199	1.064	-0.282	-2.132	-0.709	0.066	-0.144	-0.627	0.374	1.630	0.432	1.881	0.596	4.245	0.667
139	0.238	1.277	0.034	0.182	-0.323	-2.450	-0.912	-0.238	0.029	0.129	0.383	1.676	0.560	2.450	0.600	4.307	0.721
140	0.036	0.171	0.036	0.171	-0.325	-2.183	0.036	0.171	-1.091	0.000	0.500	1.940	0.438	1.698	0.490	2.765	0.659
141	0.130	0.707	0.196	1.061	-0.407	-3.126	0.000	0.000	-1.000	-0.198	0.423	1.876	0.536	2.376	0.610	4.487	0.753
142	0.034	0.185	0.102	0.555	-0.339	-2.616	0.305	1.665	0.523	0.117	0.523	2.616	-0.235	-1.047	0.614	4.578	0.873
143	0.189	1.145	0.000	0.000	-0.393	-3.374	0.189	1.145	-0.405	0.354	1.754	2.024	0.082	0.405	0.687	6.319	0.918
144	0.139	0.744	0.070	0.372	-0.348	-2.632	0.139	0.744	0.000	0.361	1.579	1.579	0.000	0.000	0.599	4.295	0.907
145	0.245	1.657	0.184	1.243	-0.367	-3.515	0.184	1.243	0.586	0.212	1.172	2.665	0.159	0.879	0.749	8.582	0.928
146	0.000	0.000	0.062	0.547	-0.324	-2.401	0.247	2.188	-0.127	0.508	0.869	4.835	0.080	0.580	0.853	16.717	0.902
147	0.227	1.588	0.170	1.191	-0.213	-2.106	0.398	2.780	-0.281	0.418	2.387	2.467	-0.271	-1.544	0.765	9.342	0.879
148	-0.034	-0.178	0.034	0.178	-0.323	-2.395	0.102	0.535	0.068	0.206	0.883	0.560	-0.029	-0.126	0.581	3.990	0.810
149	0.303	1.856	-0.303	-1.856	-0.511	-4.428	0.303	1.856	0.164	0.361	1.804	0.295	-0.229	-1.148	0.694	6.510	0.850
150	0.391	2.438	-0.090	-0.563	-0.391	-3.448	0.331	2.063	0.530	0.261	1.326	0.156	0.052	0.265	0.704	6.831	0.855
151	0.299	1.964	0.000	0.000	-0.419	-3.889	0.359	2.357	0.209	0.972	0.833	0.207	1.111	0.052	0.734	7.921	0.919
152	0.380	2.399	0.035	0.218	-0.156	-1.388	0.380	2.399	0.308	0.330	1.696	0.389	-0.270	-1.388	0.711	7.064	0.876
153	0.289	1.963	-0.032	-0.218	-0.434	-4.164	0.353	2.399	0.064	0.250	1.388	0.195	0.139	0.771	0.751	8.658	0.882
154	0.104	0.669	-0.243	-1.562	-0.451	-4.102	0.312	2.008	-0.277	-1.262	0.420	2.209	0.360	1.893	0.722	7.480	0.885
155	0.150	0.950	-0.075	-0.475	-0.618	-5.544	0.374	2.376	0.112	0.504	0.162	0.940	-0.032	-0.168	0.715	7.196	0.851
156	0.322	2.079	-0.193	-1.248	-0.450	-4.117	0.386	2.495	0.029	0.223	1.176	0.223	-0.111	-0.588	0.725	7.577	0.903
157	0.299	1.878	-0.166	-1.044	-0.398	-3.542	0.365	2.296	0.166	0.738	1.771	0.287	1.476	-0.885	0.709	7.013	0.915
158	0.292	1.759	-0.073	-0.440	-0.365	-3.109	0.438	2.638	0.328	1.399	0.190	0.933	-0.126	-0.622	0.683	6.197	0.727
159	0.246	1.580	-0.035	-0.226	-0.369	-3.352	0.387	2.483	0.105	0.479	0.274	1.436	0.030	0.160	0.721	7.437	0.923
160	0.309	2.170	-0.172	-1.206	-0.429	-4.263	0.309	2.170	0.034	0.171	0.446	0.258	-0.030	1.535	0.767	9.450	0.925
161	0.218	1.353	-0.155	-0.967	-0.513	-4.511	0.280	1.740	-0.062	-0.273	0.404	2.050	0.188	0.683	0.703	6.801	0.888
162	0.100	0.646	-0.167	-1.077	-0.401	-3.654	0.435	2.799	-0.305	0.289	1.523	0.279	3.045	-0.914	0.723	7.501	0.804
163	0.499	3.801	-0.166	-1.267	-0.356	-3.840	-0.261	-1.991	0.165	1.024	0.411	2.560	0.370	2.304	0.802	11.639	0.758
164	0.499	3.801	-0.055	-0.272	0.139	0.961	0.166	0.815	0.332	1.153	0.144	0.576	-0.240	-0.961	0.522	3.138	0.430
165	0.529	4.212	-0.144	-1.149	-0.349	-3.926	-0.240	-1.915	-0.385	-0.948	0.396	2.572	0.395	2.301	0.819	12.975	0.781
166	0.504	3.946	-0.168	-1.315	-0.372	-4.119	-0.264	-2.067	-0.408	-1.259	0.146	0.930	0.355	2.524	0.812	12.427	0.769
167	0.569	6.541	0.432	4.971	-0.273	-4.440	0.387	4.448	0.523	0.000	-0.118	-1.110	0.039	0.370	0.913	30.188	0.876
168	0.499	3.801	-0.166	-1.267	-0.356	-3.840	-0.261	-1.991	-0.428	-1.024	0.411	2.560	0.370	2.304	0.802	11.639	0.758
169	0.363	1.534	-0.121	-0.511	-0.323	-1.928	0.121	0.511	0.161	0.482	0.000	0.000	-0.140	-0.482	0.355	1.590	0.000
170	0.499	2.446	-0.055	-0.272	0.139	0.961	0.166	0.815	0.332	1.153	0.144	0.576	-0.240	-0.961	0.522	3.138	0.430
171	0.642	6.017	0.525	4.923	-0.335	-4.448	0.448	4.448	0.175	1.641	0.144	0.576	0.025	0.193	0.869	19.111	0.854
172	0.271	1.803	0.217	1.442	-0.176	-1.657	0.326	2.164	0.000	0.024	1.127	2.259	0.353	1.912	0.739	8.160	0.681
173	0.547	7.585	0.261	3.627	-0.368	-7.229	0.309	4.287	0.523	0.130	-1.166	1.166	0.021	0.233	0.940	45.239	0.905
174	0.393	2.553	0.169	1.094	-0.323	-2.966	0.225	1.459	0.903	0.024	1.129	2.219	1.161	0.903	0.727	7.567	0.737
175	0.449	3.009	0.343	2.301	-0.449	-4.256	0.132	0.885	0.000	0.000	0.229	1.252	0.091	0.501	0.744	8.374	0.846
176	0.660	4.754	0.205	1.475	0.228	2.318	0.296	2.131	-0.158	-0.927	0.079	2.464	0.079	0.464	0.778	10.103	0.847
177	0.284	1.609	0.264	1.609	-0.161	-1.391	0.205	1.252	0.126	0.127	0.632	2.149	0.076	0.379	0.691	6.425	0.794
178	0.494	3.029	0.282	1.731	0.018	0.153	0.423	2.996	0.035	0.153	0.459	-0.031	-0.153	1.071	0.694	6.528	0.872
179	0.269	2.617	-0.149	-1.454	-0.179	-2.467	0.329	3.199	-0.206	-0.259	2.056	0.311	2.467	2.879	0.879	20.801	0.950
180	0.127	1.012	-0.127	-1.012	-0.174	-1.967	0.380	3.035	-0.179	-0.192	1.252	2.325	0.356	2.325	0.820	13.115	0.874

$F > 2.51 = p < .05$; $t > 2.10 = p < .05$; $R^2 > .503 = p > .05$; Reliability $> .554 = p < .05$

APPENDIX I, page 10
Study 3, Part 2 (Post-Feedback) – Individual level Results

Conjoint Analysis 4 - Part 2 of Study 3																							
Person	β Value	t-ratio	β Rarity	t-ratio	β Immutability	t-ratio	β Limits	t-ratio	β Relatedness	t-ratio	β Rel'Rarity	t-ratio	β Rel'Value	t-ratio	β Rel'Limits	t-ratio	R ²	F-Statistic	Reliability				
181	0.113	0.815	-0.265	-1.901	-0.076	-0.768	0.416	2.987	-0.113	-0.576	0.524	3.072	0.262	1.536	0.262	1.536	0.777	10.026	0.943				
182	0.131	1.399	-0.328	-3.498	-0.197	-2.968	0.197	2.099	-0.296	-2.226	0.398	3.463	0.455	3.957	0.512	4.452	0.899	25.477	0.960				
183	0.137	1.386	-0.137	-1.386	-0.188	-2.696	0.205	2.079	-0.137	-0.980	0.325	2.696	0.503	4.166	0.384	3.186	0.888	22.880	0.917				
184	0.218	1.985	-0.156	-1.418	-0.218	-2.807	0.343	3.119	0.031	0.201	0.378	2.807	0.216	1.604	0.324	2.406	0.861	17.853	0.921				
185	0.122	1.023	-0.244	-2.046	-0.289	-3.437	0.305	2.558	-0.122	-0.724	0.396	2.713	0.290	1.990	0.396	2.713	0.837	14.755	0.895				
186	0.169	1.308	-0.440	-3.401	-0.136	-1.480	0.305	2.355	-0.068	-0.370	0.528	3.330	0.176	1.110	0.352	2.220	0.807	12.031	0.892				
187	0.139	0.937	-0.139	-0.937	-0.121	-1.159	0.346	2.342	0.035	0.166	0.270	1.490	0.330	1.821	0.270	1.490	0.748	8.553	0.863				
188	0.200	1.419	-0.267	-1.891	-0.083	-0.836	0.267	1.891	-0.200	-1.003	0.376	2.173	0.318	1.839	0.434	2.508	0.771	9.670	0.853				
189	0.139	1.029	-0.208	-1.544	-0.260	-2.729	0.277	2.058	-0.035	-0.182	0.330	2.001	0.330	2.001	0.330	2.001	0.792	10.921	0.915				
190	0.106	0.729	-0.317	-2.186	-0.246	-2.404	0.246	1.700	-0.317	-1.545	0.488	2.747	0.427	2.404	0.366	2.061	0.758	9.023	0.846				
191	0.150	0.926	-0.150	-0.926	-0.210	-1.834	0.329	2.038	-0.060	-0.262	0.259	1.310	0.311	1.572	0.311	1.572	0.700	6.703	0.864				
192	0.226	1.833	-0.161	-1.309	-0.210	-2.407	0.290	2.356	-0.032	-0.185	0.363	2.407	0.251	1.666	0.363	2.407	0.826	13.608	0.961				
193	0.289	2.484	-0.289	-2.484	-0.161	-1.951	0.289	2.484	-0.032	-0.195	0.334	2.342	0.223	1.561	0.390	2.732	0.844	15.536	0.932				
194	0.142	1.416	-0.214	-2.124	-0.160	-2.253	0.356	3.540	0.036	0.250	0.277	2.253	0.401	3.254	0.277	2.253	0.884	21.872	0.937				
195	0.231	2.284	-0.363	-3.589	-0.198	-2.769	0.363	3.589	-0.066	-0.461	0.457	3.692	0.343	2.769	0.229	1.846	0.882	21.589	0.903				
196	0.199	1.667	-0.265	-2.223	-0.232	-2.750	0.265	2.223	-0.232	-1.375	0.460	3.143	0.402	2.750	0.345	2.357	0.836	14.645	0.893				
197	0.098	0.817	-0.164	-1.362	-0.164	-1.926	0.230	1.907	-0.263	-1.541	0.398	2.896	0.512	3.467	0.398	2.696	0.833	14.338	0.918				
198	0.089	0.727	-0.148	-1.211	-0.059	-0.685	0.266	2.180	-0.177	-1.028	0.461	3.083	0.307	2.055	0.461	3.083	0.829	13.891	0.920				
199	0.240	1.496	0.651	4.061	-0.154	-1.360	0.171	1.069	-0.034	-0.151	-0.030	-0.151	-0.030	-0.151	0.386	1.965	0.704	6.852	0.917				
200	0.159	0.987	0.414	2.567	-0.159	-1.396	0.223	1.382	-0.127	-0.558	0.331	1.675	-0.055	-0.279	0.331	1.675	0.701	6.754	0.938				
201	0.269	1.514	0.500	2.812	-0.173	-1.377	0.269	1.514	0.115	0.459	0.100	0.459	-0.100	-0.459	0.233	1.071	0.636	5.031	0.882				
202	0.354	2.313	0.482	3.155	-0.193	-1.785	0.225	1.472	0.129	0.595	0.056	0.297	-0.278	-1.487	0.446	2.379	0.731	7.818	0.913				
203	0.263	1.670	0.526	3.341	-0.280	-2.510	0.132	0.835	-0.033	-0.148	0.028	0.148	-0.085	-0.443	0.484	2.510	0.714	7.194	0.935				
204	0.194	1.078	0.582	3.235	-0.259	-2.033	0.194	1.078	0.129	0.508	-0.056	-0.254	0.000	0.000	0.280	1.271	0.628	4.846	0.868				
205	0.220	1.329	0.535	3.228	-0.157	-1.343	0.220	1.329	0.000	0.000	0.164	0.806	-0.055	-0.269	0.273	1.343	0.684	6.210	0.909				
206	0.346	2.151	0.519	3.227	-0.043	-0.380	0.259	1.614	0.346	1.521	0.075	0.380	-0.449	-2.282	0.300	1.521	0.703	6.799	0.845				
207	0.290	1.609	0.419	2.324	-0.177	-1.391	0.097	0.536	0.064	0.253	0.084	0.379	-0.251	-1.138	0.531	2.402	0.626	4.811	0.866				
208	0.229	1.250	0.457	2.500	-0.191	-1.473	0.305	1.667	0.267	1.031	-0.066	-0.295	-0.198	-0.884	0.330	1.473	0.615	4.589	0.903				
209	0.229	1.392	0.425	2.584	-0.360	-3.093	0.229	1.392	0.098	0.422	0.113	0.562	-0.170	-0.843	0.340	1.687	0.689	6.363	0.941				
210	0.220	1.520	0.534	3.691	-0.188	-1.842	0.220	1.520	0.126	0.614	0.109	0.614	-0.163	-0.921	0.381	2.149	0.760	9.085	0.928				
211	0.330	2.031	0.623	3.837	-0.165	-1.436	0.256	1.580	0.220	0.958	0.032	0.160	-0.285	-1.436	0.222	1.117	0.697	6.622	0.887				
212	0.198	1.293	0.529	3.447	-0.215	-1.980	0.330	2.154	0.066	0.305	0.086	0.457	-0.029	-0.152	0.258	1.371	0.729	7.752	0.904				
213	0.034	0.188	0.573	3.188	-0.236	-1.856	0.101	0.553	-0.067	-0.265	-0.058	-0.265	0.117	0.530	0.467	2.122	0.628	4.862	0.875				
214	0.233	1.280	0.499	2.743	-0.200	-1.551	0.233	1.280	0.133	0.517	0.000	0.000	-0.115	-0.517	0.346	1.551	0.619	4.672	0.931				
215	0.365	2.101	0.426	2.452	-0.213	-1.734	0.244	1.401	0.244	0.991	0.053	0.248	-0.369	-1.734	0.369	1.734	0.652	5.397	0.950				
216	0.300	1.955	0.567	3.683	-0.117	-1.075	0.233	1.520	0.200	0.922	0.029	0.154	-0.260	-1.382	0.375	1.997	0.729	7.737	0.938				
217	0.343	2.440	0.530	3.771	-0.172	-1.725	0.343	2.440	0.250	1.255	0.135	0.784	-0.135	-0.784	0.135	0.784	0.773	9.766	0.931				
Mean	0.310		0.181		-0.252		0.239		0.134		0.103		0.183		0.146		0.756	12.863	0.816				

$F > 2.51 = p < .05$; $t > 2.10 = p < .05$; $R^2 > .503 = p < .05$; Reliability $> .554 = p < .05$